JPRS 77636

20 March 1981

China Report

SCIENCE AND TECHNOLOGY

No. 89

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Indexes to this report (by keyword, author, personal names, title and series) are available from Bell & Howell, Old Mansfield Road, Wooster, Ohio 44691.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS 77636

20 March 1981

CHINA REPORT

SCIENCE AND TECHNOLOGY

No. 89

CONTENTS

APPLIED SCIENCES

Computer Application, Popularization Making Rapid Progress (GUANGMING RIBAO, 3 Jan 81) 1

Wider Application
Penn State, Jiaotong Universities Work Together, by Wu Hongue, Xing Pingan

Ground-Based Multispectrum Photography Tested (Wang Changyao, Zheng Lanfen; ZIRAN ZIYUAN, 6 Mar 81) .. 3

Cloud Chart Facsimile Technology (Liu Chengbang; DIANZI KEXUE JISHU, No 11, 1980) 19

PUBLICATIONS

Table of Contents of 'HUAGONG XUEBAO' No 4, 1980 35

Table of Contents of 'HE JISHU' No 6, 1980 37

Table of Contents of 'KEXUE HUABAO,' January 1981 39

ABSTRACTS

ELECTRONICS

DIANZI XUEBAO [ACTA ELECTRONICA SINICA], No 4, 1980 43

ENGINEERING

NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY], Nos 2, 4, 20 Jan, 20 Dec 80 50

LASERS

JI GUANG [LASER JOURNAL], No 10, Oct 80 62

RURAL TELECOMMUNICATIONS

NONGCUN DIANXIN JISHU [TECHNOLOGY OF RURAL TELECOMMUNICATIONS], No 6, 15 Nov 80 69

SHIP ENGINEERING

CHUANBO GONGCHENG [SHIP ENGINEERING], No 6, 1980 71

TELECOMMUNICATIONS

DIANXIN KUAIBAO [TELECOMMUNICATIONS INFORMATION], No 11, Nov 80 73

COMPUTER APPLICATION, POPULARIZATION MAKING RAPID PROGRESS

Wider Application

Beijing GUANGMING RIBAO in Chinese 3 Jan 81 p 1

[Article: "China Now Has Three Thousand Computers in Use"]

[Text] As reported by reporter Wang Xingzhong [3769 5281 0022], in recent years, China has achieved fairly rapid progress in the application and popularization of electronic computers. According to related statistics, there are now three thousand large, medium and small general-use digital computers throughout the entire country, as well as large numbers of analog computers, special computers, microcomputers, and desk computers. The entire country now has some 500 computer centers (stations); major scientific research academies, institutes, schools of higher education and large-scale enterprise organizations in various provinces, urban districts and autonomous regions as well as large and medium cities are basically equipped with electronic computers.

In the application and popularization of computers, many districts and organizations throughout the country are by-passing administrative bounds and pooling their efforts in various ways, such as dividing software research and development projects among themselves, thus turning computers into a productive force for advancing the four modernizations. For example, in architectural designing, some research academies and institutes have jointly developed specialized computer languages and application software systems which are powerful, flexible, readable, easy to learn and understand, and quite well received. The Shanghai Research Institute of Shipbuilding Technology and Hudong Shipyard use Chinese-made 709 and 320 type computers in extensive efforts to develop application software; as a result, computers have replaced some of the old traditional technological methods in the Shanghai Hudong Shipyard, Jiangnan Shipyard and other major enterprise organizations, and become their productive force and indispensable component link. Based on local conditions, quite a few provincial and municipal computer centers (stations) are applying computer technology in agriculture and have achieved excellent results in helping to develop agricultural production.

Due to the wide application and popularization of electronic computers in various sectors of the national economy, many districts, [government] departments and organizations across the country attach great importance to training computer specialists. The Ministry of Education also emphasizes the training of computer specialists. Based on the statistics of 37 higher educational schools directly under the Ministry of Education, 16 of them have already set up computer disciplines. Computer departments have also been established in quite a few other affiliated organizations and local colleges and schools. In recent years, secondary-level computer vocational training schools and technical schools have sprung up all over the country, turning out multitudes of computer specialists and technical workers each year.

Penn State, Jiaotong Universities Work Together

Beijing GUANGMING RIBAO in Chinese 3 Jan 81 p 1

[Article by Wu Hongue [0702 7703 2814] and Xing Pingan [9388 1627 1344]

[Text] The Shanghai Jiaotong University and Pennsylvania State University are collaborating on a joint project to train Chinese computer management enterprise specialists, and the first graduate student class (preparatory course) in Jiaotong University was formally opened on December 8, 1980.

The graduate student class was established through the positive contributions of Mr Zhu Chuanju [2612 0278 2829], an American scholar of Chinese descent who had travelled far and wide, and many times across the ocean to establish the ties, and Mr Rong Hongyuan [2837 7703 0337], a well-known personage who had donated one million yuan.

Mr Rong Hongyuan was formerly one of the board directors of the Shanghai Shenxin Textile Mill, and a large shareholder as well. When the mill was converted into a joint state-private enterprise, his assets were kept in a domestic bank with fixed interest. As an aluminus of the Shanghai Jiaotong University, Mr Rong wanted to contribute part of his dividends to his alma mater.

Last November, when his son-in-law Mr Zhu Chuanju and daughter Rong Zhizhen [2837 2535 3791] were invited to Jiaotong University, they learned about the lack of material resources and qualified teachers in Jiaotong University's Industrial Management Department which also lagged behind the most advanced level in other countries. With the permission of their father-in-law Mr Rong Hongyuan, they decided to donate some money to the department. But Mr and Mrs Zhu Chuanju also felt that the donation alone was not sufficient to solve the problem thoroughly. So, on their return to the United States, they got in touch with the deans of the Computer Sciences School of the Pennsylvania State University, and consulted with them about establishing sister school ties between Penn State University and Jiaotong University. Both sides were to set up funds for the convenience of personnel and academic exchanges between both parties.

In March 1980, Mr Zhu Chuanju, who was over 60 years old, crossed the ocean again to discuss specific matters with Shanghai Jiaotong University. It was decided that Shanghai Jiaotong University's funds would be raised from the one million yuan which Mr Rong Hongyuan offered to donate out of his personal bank interest, while Pennsylvania State University's funds would be raised through other sources.

In the respective months of June and October 1980, Penn State University sent Mr (Previs), Chairman of the Computer Committee, and Vice President (Rubin) to hold consultations with Jiaotong University, and work out specific arrangements for the graduate students class.

9119
CSO: 4008

APPLIED SCIENCES

GROUND-BASED MULTISPECTRUM PHOTOGRAPHY TESTED

Beijing ZIRAN ZIYUAN [NATURAL RESOURCES] in Chinese No 2, 6 Mar 80 pp 66-76

[Article by Wang Changyao [3769 7022 5069] and Zheng Lanfen [6774 5695 5358], Research Institute of Remote Sensing Applications, Chinese Academy of Sciences: "An Experimental Study of Ground-Based Multispectrum Photography"*]

[Text] Multispectrum photography is a new remote sensing technology which has been developed in recent years. In the early 1960's, U.S. scientists developed the first multispectrum photographic apparatus in order to detect possible underground nuclear explosions by aerial reconnaissance. In 1965 the Apollo 9 spacecraft carried an SO-65 multispectrum camera consisting of 4 Hansibulaite [phonetic] cameras and took the first multispectrum photographs of earth from space. Since 1972 the United States has launched the Earth Resources Technology Satellite [ERTS] and Skylab. These two spacecraft both were equipped with multispectrum cameras and multispectrum scanners. Analysis of the data obtained from the sensors made it clear that multispectrum photography has extensive prospects in such areas as agriculture, forestry, geography, cartography, oceanography, geology and environmental science.

In recent years, as this country's remote sensing technology has rapidly developed, the authors have frequently taken part in airborne and ground-based multispectrum experiments, and on the basis of an analysis of the experiments and the data they yielded, the authors believe that multispectrum photography can be carried out not only from satellites and aircraft but from the ground surface as well.

1. The Principles of Multispectrum Photography

Multispectrum photography was developed from ordinary aerial photography. It has both similarities to conventional photography and its own unique characteristics.

The images photographed in ordinary photography record the brightness of ground objects in solar radiation. The differences in tint of the images are related to the brightness coefficient R:

---

*Zeng Mingxuan [2582 2494 3551], Li Huiguo [0536 1920 0948] and Ren Fengqing [0117 7685 3237] also took part in the ground-based multispectrum photography experiments.

$$R = \frac{B}{B_{\text{abs white}}}$$

where B is the surface brightness of the object and $B_{\text{abs white}}$ is the brigntness of an ideal absolutely white surface.

The greater the brightness coefficient, i.e. the greater the brightness of the object, the lighter the tint in the photograph; conversely, the smaller the brightness coefficient, and the smaller the brightness, the deeper the tint in the photograph.

The images obtained in multispectrum photography record the electromagnetic radiation from the sun reflected by surface features in the spectral region of the photograph. The features' ability to reflect sunlight is expressed in the study of spectral characteristics by the reflectivity:

$$\text{reflectivity} = \frac{\text{reflected energy}}{\text{radiated energy}} \text{ percent.}$$

In nature different objects have different abilities as regards radiating and reflecting electromagnetic waves, so that black-and-white photographs taken in different spectral regions can produce changes in tone and grayness. Differences in objects' abilities to reflect electromagnetic radiation depend mainly on their chemical composition and physical nature. When we understand an object's radiation characteristics in different spectral bands we can determine what kind of an object it is. Accordingly, to obtain high-quality multispectrum test results we must make studies of the radiation characteristics of surface features and of optimal band selection.

Figures 1 and 2 show the reflection spectrum characteristic curves of several types of objects. It can be seen that fresh snow has a strong reflectivity in the visible region, so that the tone in a photograph will be rather bright; water and black earth have relatively low reflectivity over the entire spectral range and will give a rather dark tone in a photograph. Deserts have a peak at about 6000 A, and accordingly they have a reddish-brown appearance. Plants have a peak at about 8000 A, primarily because the chlorophyl of healthy plants is highly reflective of near-infrared radiation.

We can see from Figure 1 that the spectral curves for black earth and water surfaces cross at about 6000 A and gradually separate on both sides of this wavelength. Accordingly it is rather difficult to use photographs taken in the region around 6000 A to distinguish these 2 types of features; better results are obtaining by taking photographs in the 4000-5000 A and 7000-8000 A ranges. In photographs taken in the former range, the color of water will be lighter than that of black earth, while in those taken in the latter range the water will appear darker than the black earth because water absorbs near infrared radiation rather strongly. Similarly, the reflectivities of plants are rather close in the

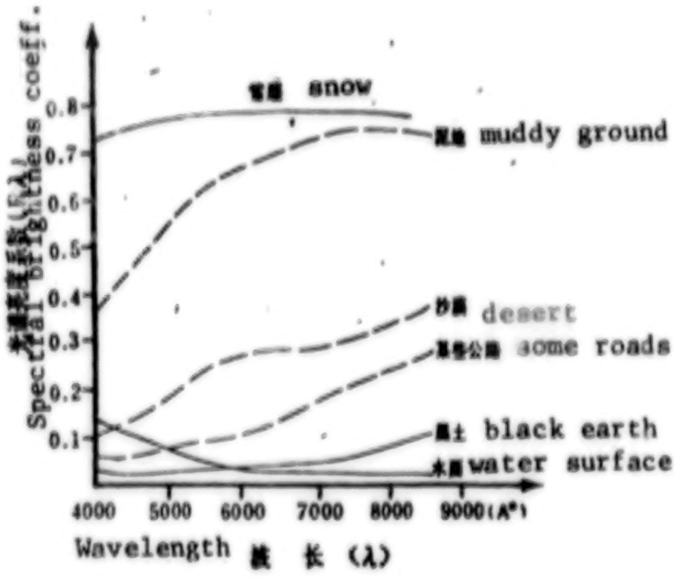


Figure 1. Spectral Characteristics of Snow, Water, Desert and the Like*

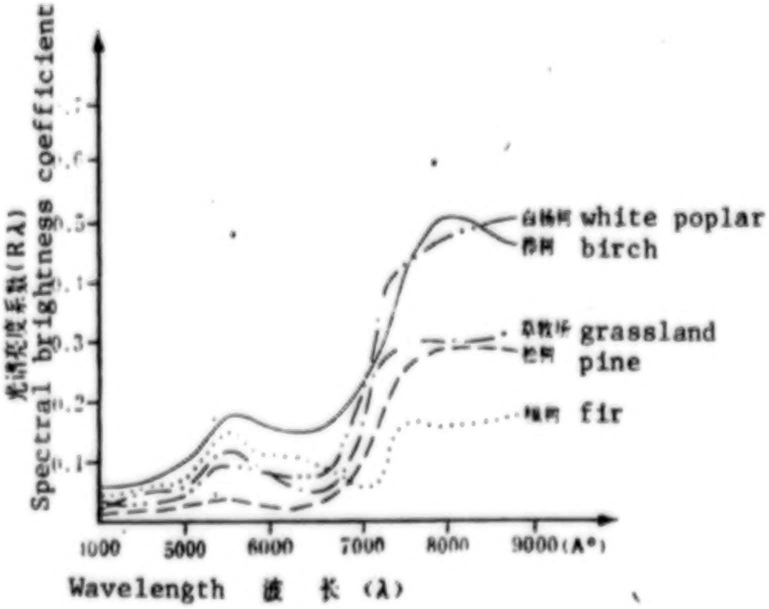


Figure 2. Spectral Charactierstics of Green Plants*

* Figures 1 and 2 are from "A Course in Aerial Photography"

visible region, but in the vicinity of 7000-8000 A their curves separate. Because leaf structures of plants differ, they have different reflectivities, with broadleaved plants generally showing higher reflectivities and plants with needles showing lower reflectivities. Healthy plants have rather strong reflectivities and the leaves of diseased plants have weaker reflectivities, so that by using photographs taken in the 7000-8000 A region is it possible to distinguish certain categories of plants and determine their health.

Multispectrum photography selects spectral regions in which ground features have large differences in reflectivity or which differ rather widely in wavelength as the best bands for photography on the basis of this physical characteristic of the objects. Photographs of a ground object are taken in several spectral regions using different combinations of filters and films and analyzed comparatively to distinguish slight differences in the reflectivity of ground objects; the narrower and more numerous the spectral regions chosen the more favorable for distinguishing objects, but in this case the quantity of information becomes large and processing it becomes rather complex.

Generally multispectrum photography systems use the ultraviolet, blue, green, orange, red and infrared regions. The ultraviolet region is used primarily in monitoring ocean pollution such as oil pollution; the fluorescence produced by oil pollutants makes them show up rather brightly in ultraviolet photographs, while sea water appears rather dark, enabling them to be distinguished. Although the blue and green regions are affected by the atmosphere and image definition is rather poor, because these wavelengths have some capability to pass through water, they are frequently used in observing ponds, seashores, underwater topography, suspended material and underwater vegetation. The red region is used in observations of topography, city buildings and roads, because these objects have rather strong reflectivities in this range, so that their details are rather clearly shown in photographs made in the red region. In the near infrared it is easy to distinguish plants, unmask camouflage, probe bodies of water and distinguish water and land outlines, and in addition, because infrared light has a certain ability to pass through thin cirrus cloud it is also used in the study of cloud height, thickness and distribution. Naturally, the choice of wavelengths will depend on the object of the observations.

The difference between multispectrum photography and conventional photography is that in the former photographs are taken in many spectral regions and that the data obtained in this way contain a large quantity of information; it is convenient to use electronic and optical methods to enhance the chromaticity of the objects studied and to use computers for automatic analysis, making it possible to increase greatly people's ability to distinguish remote sensing images.

2. Experimental Equipment for Ground-Based Multispectrum Photography.

A wide variety of instruments are used in multispectrum surface photography. Since 1973, we have tested the following types of instruments:

A. A land photographic theodolite. The land photographic theodolite (Figure 3) has an image size of 13 x 18 centimeters with a rather large field of vision. It can photograph a rather large area and take in more objects. Because it has a direction finding attachment, a level indicator and a holding screw, each photograph can be aligned on the same object. In addition, this device has a fixed frame in its lens case focal plane, so that during color synthesis the different photographs can be aligned by means of the frames in them.

In using the land photographic theodolite for multispectral photographs, the interchangeable filter method is generally used: a filter holder is generally added in front of the lens, and the filter is changed after each photograph in a given spectral range. When this method is used for multispectrum photography, only one image in a spectral region can be taken each time. To take multispectrum photographs the film must be changed and different filters inserted.

Figure 3. A Lang Photographic Theodolite Used in Multispectrum Photography. A is the holder for interchangeable filters.

Figure 4. A Portable Four-Lens Multispectrum Camera

B. A hand-held multispectrum camera. This consists of several ordinary cameras. Figure 4 shows a ground-based multispectrum camera made from four Changcheng brand cameras. Its main advantages are that it can photograph continuously and is rather light. The four Changcheng 135 cameras are arranged in two rows and fixed in a frame. The frame contains a connecting bar, and there are four pushbuttons on top of the cameras which are connected to their shutters, so that when the connecting bar level is pressed the four pushbuttons open the four shutters, and the four cameras are exposed to light at the same time. When the lever is released, the four buttons release the shutters, and after exposure the shutters automatically return to their original positions, thus making a multispectrum photograph and producing images in four spectral ranges.

In order to assure correct overlay when combining the four multispectrum photographs, the four cameras must be aligned before taking the pictures.

C. Ordinary portable cameras can generally also be used for multispectrum photography. The method is to add various filters in front of the lens. When using this method to take multispectrum photographs the camera can be placed on a tripod or stand, but it must be firmly fixed in place to avoid shifting of the camera between pictures, which would result in difficulty in superimposing them for synthesis.

A wide variety of filters is used in ground-based multispectrum photography. Filters identical with those used in satellite or aircraft multispectrum photography can be used for convenience in comparative analysis. In addition narrowband filters can be used to determine the reflectivity of the objects in each range. Interference filters can also be used for experiments: the narrower the wavelength range the more advantageous for detecting differences in the reflectivity spectrum of different ground objects.

As for the films used in ground-based multispectrum photography, one film can be used with different filters or different films can be used. In addition to polychromatic film, ultraviolet, blue-sensitive, green sensitive, infrared, color and black-and-white film can be used. The use of different light-sensitive materials for tests on one object makes it possible to understand through analysis and comparison an object's effects in different light-sensitive materials, thus providing reference data for the selection of suitable light-sensitive materials for aerial remote sensing experiments.

In summary, when multispectrum photography is carried out on the ground, although there are the disadvantages of a small field of vision and the oblique nature of the photographs, they can produce definitive observations of a fixed object, which is convenient for comparison of differnt filters and films, and it is possible to use more and narrower spectral bands than in satellite or airborne photography. Thus, the method can provide ground-based test data for satellite or airborne sensor wavelength selection and exposure conditions test. In addition, the same spectral regions as for satellite and airborne multispectrum photography can be used for experiments made in the test area while making simultaneous observations from satellites and aircraft. A comparative analysis can be made of the multispectrum photographs, thus providing data on actual surface conditions for use in interpreting and analyzing remote sensing imagery.

In addition, multispectrum photography on the ground is rather flexible. It can be carried out at different times from different observation points with different observation methods. Photographs can be made at one location several times in the year, making it possible to monitor the dynamic natural changes over the four seasons. Similarly, because the instruments used for multispectrum experiments on the ground are simple and light and one test is not as expensive as launching a satellite or carrying out airborne observations, it can be extensively employed by the broad mass of users.

3. Tests of Ground-Based Multispectrum Photographs and Analysis of Results

In the fall of 1973 we carried out the first ground-based multispectrum photography, choosing an agricultural area in the Beijing suburbs as our experimental site. Then main crops in the area were millet, corn, Chinese cabbage and the like (Figures 5 and 6). The experimental device was a land photographic theodolite, which was placed atop a building for the tests, making oblique photographs of the test area. The light-sensitive material used for the photographs was dry traviolet plates, with a sensitivity range of 2500-5000 A. Interchangeable filters were used. The filters were of the dry type, and filters for a total of five spectral bands were used. The filters' peak wavelengths and maximum transmissivities are shown in Table 1.

Table 1. Characteristics of Interference Filters Used in Multispectrum Color Photographs

Peak wavelength (nanometers)	463	510	536	556	625
Maximum transmissivity (percent)	31.0	34.0	47.4	28.0	31.0
Width (nanometers)	6.8	8.4	7.5	7.6	8.3

Figure 5. Photograph of the Test Site

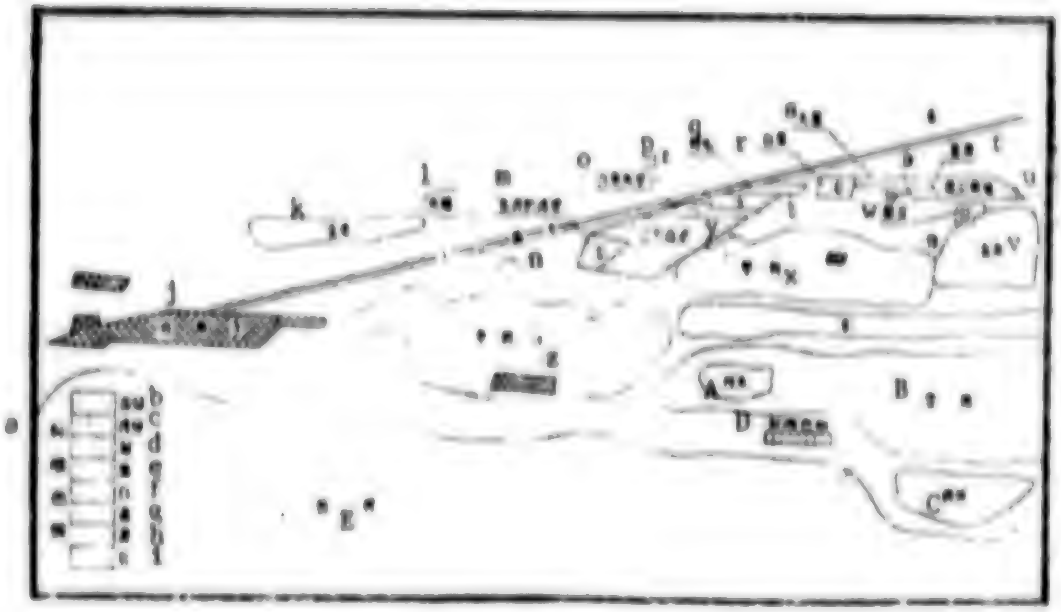


Figure 6. Map of Multispectrum Field Test Area (21 September 1973)

Key:

a. Standard color board
b. Dark green
c. Light green
d. Green
e. Black
f. White
g. Blue
h. Yellow
i. Red
j. Brick building
k. Corn
l. Paddy rice
m. Growing Sorghum

n. Earth highway
o. Chinese cabbage and radish
p. Chinese cabbage
q. Hot pepper
r. Chinese cabbage
s. Green onions
t. Chives
u. Apparently plowed land
v. Corn
w. Pole beans
x. Jujube trees
y. Harvested sorghum
z. Jujube trees

A. Sewage
B. Wasteland
C. Unburnt brick
D. Standard colorboard
E. Willows

During the experiments, in order to partially eliminate certain factors such as differences in the solar angle and exposure time, and also in order to test the reflection of various colors in various spectrum regions, we set up five 80 x 80 cm color boards in the test area. The colors used were red, yellow, blue, white, black, green, light green and dark green.

Because the spectral transmission ranges and transmissivities of the filters were different from the sensitivities of the film at different wavelengths, the exposure times differed for photographs in various spectral bands. The shortest was 4 seconds and the longest 12 seconds (Table 2). The increase in exposure time after 625 nm was primarily owing to the fact that the emulsion sensitivity was already rather low in this spectral region.

Table 2. Multispectrum Photography and Processing Conditions

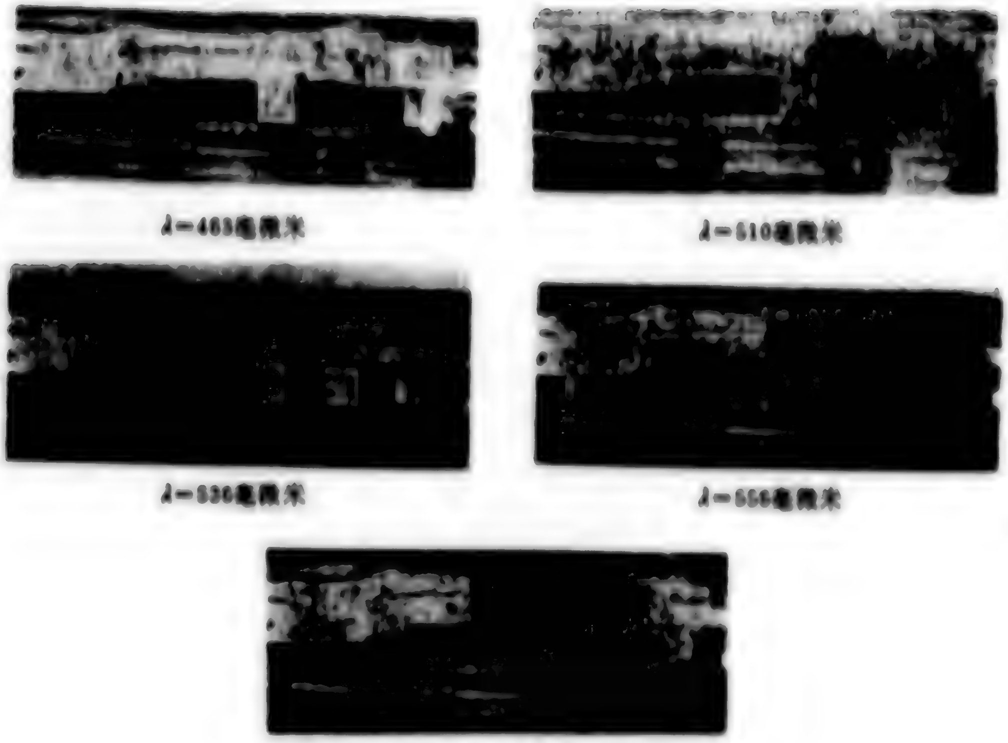
b 摄影及处理条件 a 滤光片峰值波长(毫微米)	曝光速度 (秒) c	摄影时间 d	e 处理条件		
			配 f 方	显影时间 (秒) g	摄影材料 h
463	5"	j 上午10:45	D72	4	紫外型干版 i
510	4"	9:30	D72	4	〃
536	5"	9:45	D72	4	〃
556	5"	10:55	D72	4	〃
625	6"	11:16	D72	4	〃

Key:

a. Peak wavelength of filter (nm)
b. Photographic and processing conditions
c. Exposure speed (seconds)
d. Time of photograph
e. Processing conditions
f. Formula
g. Development time (seconds)
h. Photographic material
i. Ultraviolet dry plate
j. AM

The analysis of the multispectrum photographs made use of an MF [Cyrillic letters] model densimeter. During analysis, in the negative for each spectral region the transmissivity for the "black board" was defined as 100 percent, because it was believed that the black board had uniform absorptivity in all of the spectral regions and had very low reflectivity. Thus, when determining the density of the photographs in the various spectral regions, the black board was used as a standard for calculation so as to obtain the relative transmissivities; in order to eliminate sampling error and reading error, an average of three values from different locations on each object was used.

Figures 7 and 8 are photographs of the color boards and ground features taken in the various spectral regions. Figures 9 and 10 are histograms of T (transmissivity) and λ (wavelength) for the color boards and the different ground features based on the relative transmissivities of the negatives made in 6 spectral regions.



λ=465毫微米

λ=510毫微米

λ=536毫微米

λ=556毫微米

λ=625 毫微米

(1)

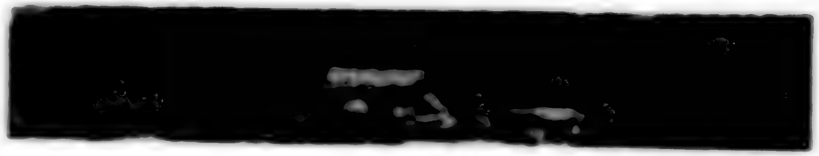
Figure 7. Changes in Grayness of White Board Photographed in Different Spectral Regions

It can be seen from these data and image analysis that in the 625 nm photograph the red board had a transmissivity of over 90 percent. The yellow board began to have a transmissivity over 90 percent at 536 nm.

This phenomenon is owing primarily to the fact that the yellow board reflected rather strongly in the yellow spectral region and the red board reflected rather strongly in the red region. In the blue and green spectral regions, however, they reflected rather weakly, so that the tones of the photographs are rather dark. Accordingly, yellow and red objects can be distinguished by comparison of the 536 and 556 nm wavelength regions and are rather difficult to distinguish in other spectral regions. Similarly, the blue and red boards showed a rather large difference in transmissivity in the 625 nm photograph, while in the photographs taken in other wavelengths the differences were rather small, so that the 625 nm region is most suitable for distinguishing red from blue. Because the green and dark green boards differed only slightly in color when made, they did not show any marked contrast in photographs taken in the six spectral regions. It was only in the 536 nm photograph that the light green board showed a clear difference from the green and dark green boards.

毫微米 = Nm

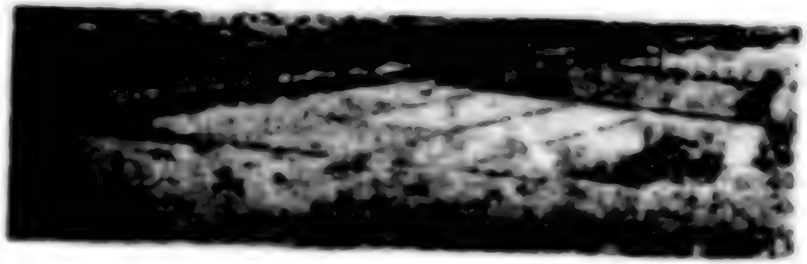
λ=483毫微米



λ=483毫微米

λ=510毫微米

λ=510毫微米



λ=536毫微米

λ=536毫微米

(1) 毫微米 = Nm

Figure 8. Various Ground Objects Photographed in Various Spectral Bands

Key:
1. Sorghum
2. Chinese cabbage and radishes
3, 4 Chinese cabbage
7. Hot pepper
12. Green onions
14. Chives

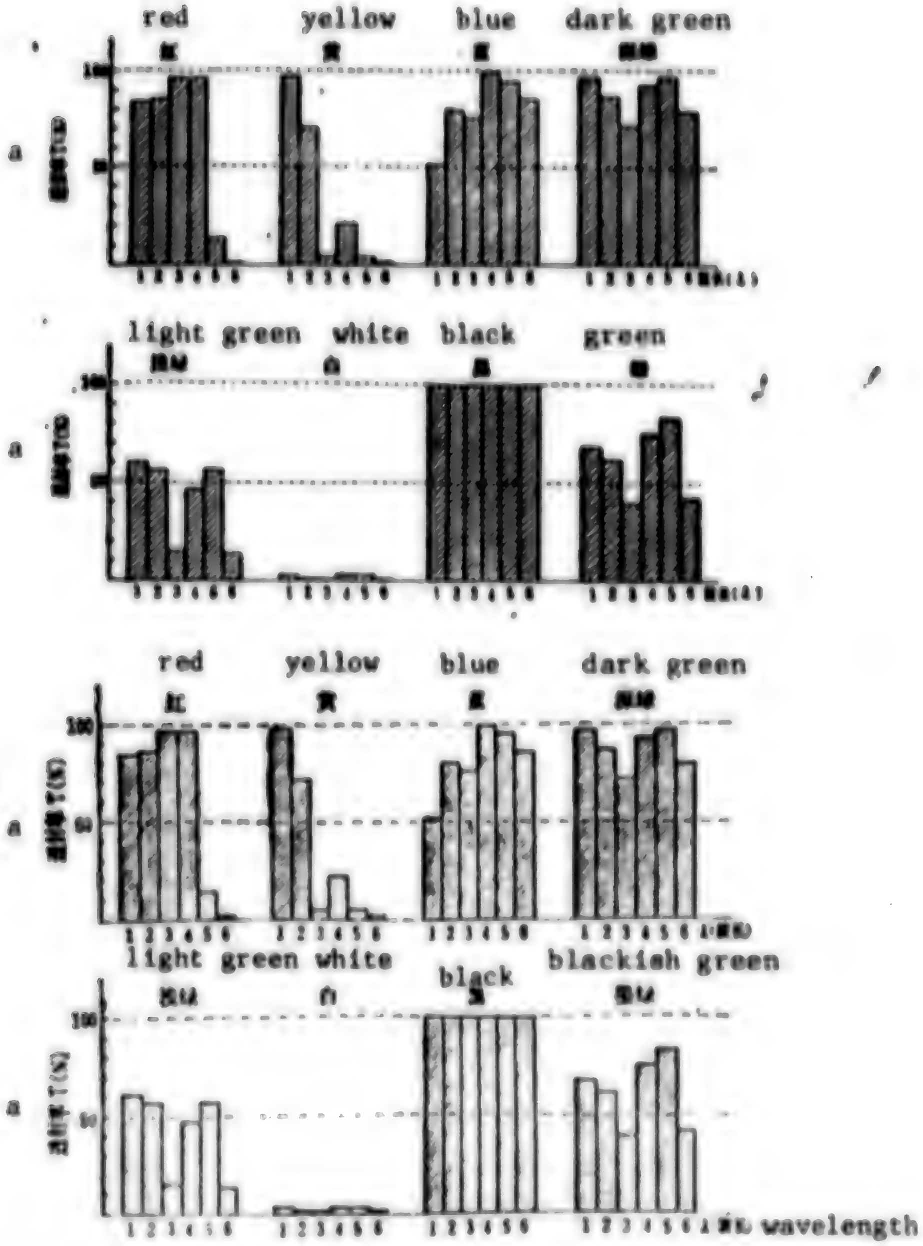


Figure 9. T-λ Histograms for Different Color Boards

Key:

a. Transmissivity T (percent)

1. 463 nm
2. 510 nm
3. 536 nm
4. 556 nm
5. 625 nm
6. 674 nm

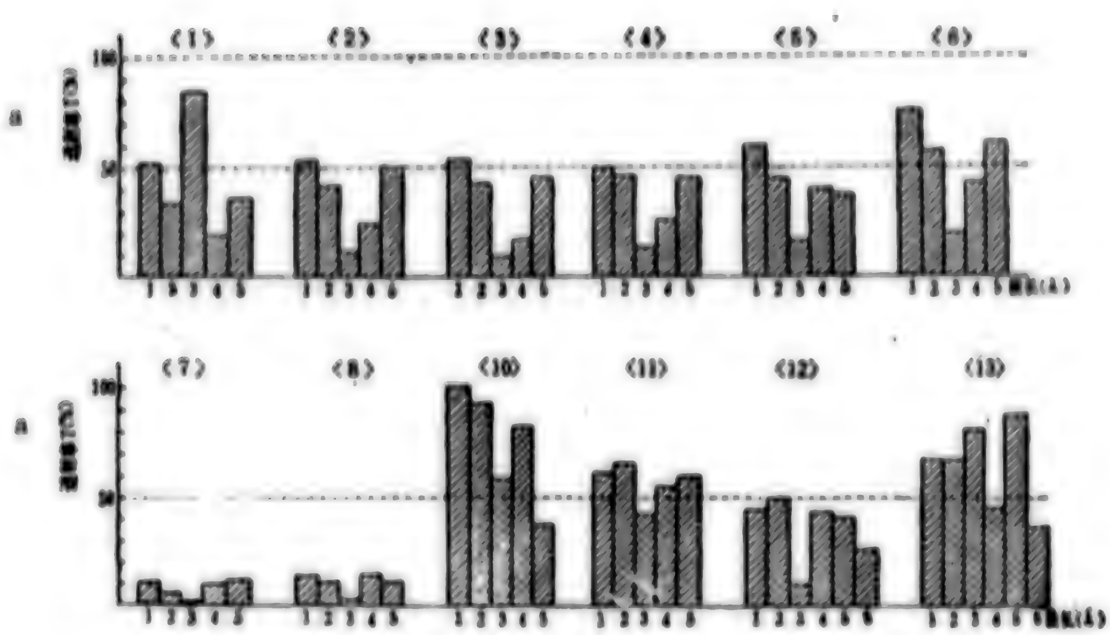


Figure 10. T-λ Histograms for Different Ground Objects

Key:

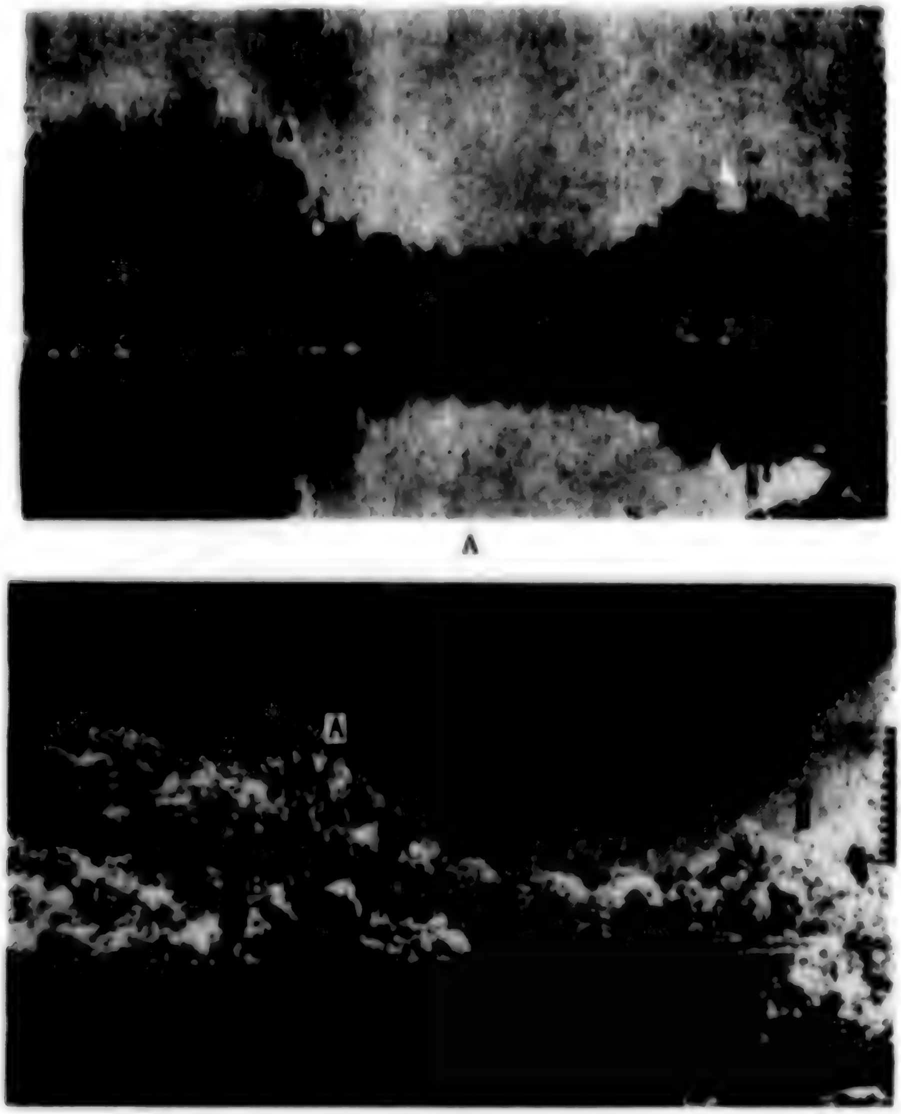
a. Transmissivity T (percent)

1. 463 nm
2. 510 nm
3. 536 nm
4. 556 nm
5. 581 nm
6. 674 nm

In order to study crop differentiation effects and differences in photographs made at different wavelengths, we chose sorghum, Chinese cabbage and radish as backgrounds for photographs in the various spectral regions. As a result of density measurements and image analysis it can be seen that growing sorghum and already-harvested sorghum areas show a rather large difference in transmissivity in the 536 and 625 nm regions, while an area interplanted with Chinese cabbage and radish showed rather large differences with an area planted to Chinese cabbage alone in the 536 and 556 nm regions, with the Chinese cabbage having rather strong reflectivity in the yellow range and a rather light tone and the area interplanted with Chinese cabbage and radish a rather dark tone; photographs taken in other ranges did not show any great differences in tone between the two crops, so that they were rather difficult to distinguish. Photographs of green onion fields taken in the 556 nm range show a transmissivity of 43.7 percent, while that for Chinese cabbage fields was 26.0 percent, a rather large difference in relative transmissivity; in the photographs taken in other ranges the differences between these two crops were rather small. Photographs of pepper fields showed only small changes in transmissivity in the various spectral regions.

It can be seen from the above analysis that these agricultural crops showed rather small differences in the green and blue regions, but their reflectivity differences gradually increased in the green, yellow and red ranges. Accordingly, to distinguish various wild plants, the sensing must be done in the spectral regions to which this ground cover is most sensitive. In order to determine the optimal spectral regions, rather narrow bands must be used in large numbers of tests. Autumn, when the tones of the various plants show wide variation, is especially suitable for pursuing ground-based multispectrum photography experiments.

Ground-based multispectrum photographic experiments can be used not only in agriculture but also in forest surveys, in which near infrared-sensitive films are used for tests, producing rather good results. Photograph 11a was taken with polychromatic film and photograph 11b with black-and-white infrared-sensitive film.



A

B

Figure 11. Comparison of Photographic Effects on Polychromatic and Infrared Film

Key: A. Broadleaf trees B. Needle-leaf trees C. Radar installation

We can see from comparative analysis of these two photographs that the spectral differences between trees with broad leaves and trees with needles are rather small on the polychromatic film, but the tone of the needle-bearing trees is rather darker on the black-and-white infrared film and that of the broad-leaf trees lighter, making it quite easy to distinguish them. This is because the leaves of broad-leaf trees are large, so that they reflect rather strongly in the near infrared, giving a bright tone in the photographs, while needle-type leaves are small and sharp and not very reflective, so that their tone in the photographs is dark. Most striking is the fact that the chlorophyll in the leaves of living green trees reflects strongly in the near infrared, while the nonliving, green-painted radar does not have this characteristic. In the polychromatic film the tone does not make it easy to distinguish the radar installation from the trees, but in the infrared picture, because the radar installation reflects weakly, it has a dark tint and the trees have a rather light tint, so that the installation concealed among the trees becomes clearly visible. The camouflage-detection reconnaissance which has developed since World War II has been based on such characteristics.

In summary, while carrying out earth surveys from space-based sensors, we must also carry out ground-based determinations of the spectral characteristics of large numbers of ground objects and studies of various types of sensors on the ground. Only in this way will we be able to adapt to the rapid development of space technology and provide more information for knowledge of the natural world.

8480
CSO: 8111/0626

CLOUD CHART FACSIMILE TECHNOLOGY

Beijing DIANZI KEXUE JISHU [SCIENCE AND TECHNOLOGY OF ELECTRONICS] in Chinese No 11, 1980 pp 2-7

[Article by Liu Chengbang [0491 2110 6721] of Shanghai Wired Radio Plant: "Cloud Chart Facsimile Technology"]

[Text] With the development of meteorological satellites, the application of cloud chart facsimile is becoming increasingly extensive. Our country began to pick up cloud picture transmissions with Chinese-made facsimile receivers way back in 1969, and was one of the earliest countries which began to apply cloud chart data in meteorological forecasting and scientific research. Today, cloud picture facsimile is widely used throughout the whole country, and has become an indispensable and important means of meteorological work.

The article focuses on the application of cloud chart facsimile, and introduces some of its characteristics and general principles.

Meteorological Satellite and Cloud Chart Facsimile

Since ancient times, man has always attached great importance to meteorological observation; he often relies on valuable meteorological information to determine whether agricultural production will turn out to be a bumper harvest or crop failure, or whether military action will be to his advantage or disadvantage. Today, science is developing by leaps and bounds, and in order to play a dynamic role in all kinds of activities, it has become increasingly necessary for man to assume full command of reliable and complete meteorological information.

But four-fifths of the earth's surface is covered with sea, and a considerable portion of land is uninhabitable areas either covered with mountains and deserts, or situated in the polar regions. Thus, it is practically impossible to obtain meteorological information on global scale by merely relying on ground surface observation posts which can only obtain a limited scope of data. Meteorological workers now have a powerful tool--artificial satellites which can carry all sorts of observation instruments and enable observation of the atmosphere and the earth to be conducted from outer space. Thus, it is now possible to gather massive volumes of precious information through the employment of meteorological satellites.

It has been some 10 years since the birth and first application of the meteorological satellite. Up to now, many different types of satellites have been developed for meteorological observation, and there are also a great variety of probing methods. In this article, only two types of meteorological satellites designed for comprehensive observation will be introduced.

One type is known as near-earth polar-orbiting satellite as it orbits relatively close to the surface of the earth (approximately 800-1,400 km) and continuously around the two poles of our planet. Global observation can be achieved by setting the orbit of the satellite to the proper inclination angle (i.e. angle between the plane of the orbit and the plane of the earth's equator), altitude and period, and thus obtain high altitude and surface data covering all parts of the world.

As this type of satellite circles continuously around the earth in a relatively low orbit, it has the capability to provide regional information of fairly high resolution, which serves as very valuable reference to local meteorological forecasters in those areas. By putting together all the regional information, it is possible to produce overall meteorological information covering the entire globe in a given period of time, which is extremely useful for studying the meteorological development trend of the entire globe.

The other type of satellite circles around the earth in a fairly high orbit (approximately 36,000 km), and is called a synchronous satellite because its period of revolution coincides with the earth's period of rotation. As it appears stationary relative to the earth, it is also called geostationary satellite.

The synchronous satellite is used for monitoring a certain region of the earth (approximately two-fifths of the earth's surface), and it maintains a round-the-clock watch over the meteorological developments of this particular region. This way, it can send back continuous meteorological information of the area, which is especially useful for predicting certain kinds of fast-changing inclement weather.

Besides, the synchronous satellite can also be used as a repeater station for retransmitting data which had been gathered and processed with computers by meteorological centers to medium and small observation posts. This allows more local posts to acquire processed data which are fairly comprehensive, and thus helps them to overcome difficulties created by inadequate equipment.

By combining the merits of each of the preceding types of satellite, it is possible to acquire lots of valuable meteorological information for making relatively accurate prediction and conducting research work.

Among the various types of information obtained through satellite observation, cloud cover photographs (commonly known as cloud pictures) are one kind that provide visual information, which is of great use value. With various kinds of scanning radiometers, the satellite can take scanning pictures of the terrestrial surface. Based on the principle of facsimile, it can clearly reflect the atmospheric cloud layer structure through a single picture, and all sorts of meteorological features of the earth's surface as well. The pictures give a bird's eye view of all sorts of weather phenomena, which provide an extremely effective means of predicting such inclement weather as typhoons and rainstorms, and probing such phenomena as the freezing of sea water and melting of mountain snow.

The type of telephoto device used here for receiving cloud pictures is called cloud chart facsimile receiver. There are two kinds of satellite photo transmission systems: APT (Automatic Picture Transmission) and HRPT (High Resolution Picture Transmission). The corresponding fax receivers in our country are models 118 and 121.

As far as its working principle is concerned, the cloud picture facsimile receiver functions like an ordinary news telephoto device; they both use the photoelectric principle, and accomplish photo-reproduction by means of mechanical scanning. The most essential requirement here lies in the ability to faithfully reproduce the photographed scene without creating any distortion detectable to the human eye. This is achieved by setting even higher standards than documentary facsimile either in terms of circuitry processing of signals or precision of mechanical processing and image resolution of the optical system. Thus, the designing and manufacturing of this particular type of equipment fall in the category of photographic facsimile.

The Characteristics of Cloud Picture Facsimile

As described above, cloud chart facsimile and photographic facsimile are of the same type of system, and there is not so much difference between them as far as their working principle is concerned. But as the former transmits cloud pictures from an orbiting satellite, its performance indices and design features are clearly different from those of news telephotography.

1. Determination of Technical Parameters

The quality of satellite photographs must meet the requirements of analytical processing. On the other hand, the design parameters of ground station terminals should be adapted to the satellite signal transmission system. This is particularly true when receiving transmissions from foreign satellites, as there is no room for options at all. For example, the American satellite NOAA orbits around the earth at the mean altitude of 1,400 km in approximately 2 hours, its surface resolution is 0.85 km. Then how to determine the facsimile parameters for taking 457 x 600 mm photographs?

First, the density of the scan lines is computed according to the reception range of ground stations, the size of the photographs, and the required resolution for taking pictures of substellar-point sceneries. As shown in Figure 1, the reception range (approximately one-fifth of the orbit and period) of the ground station is initially determined from the altitude and widest angle of the satellite as it passes overhead. Thus, the satellite's scanning radiometer can scan the terrestrial surface within the span of:

$$\overset{\frown}{AB} = \frac{1}{5} \times 2\pi R$$

in which R is the earth's radius. R = 6,400 km.

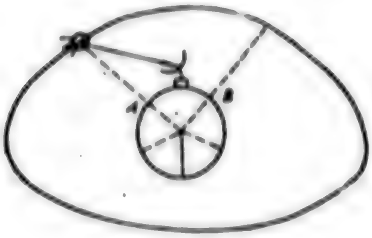


Figure 1

Hence, $\overset{\frown}{AB} = \frac{1}{5} \times 2\pi \times 6{,}400$ km = 8,038 km.

Based on the resolution requirements, the substellar point is 0.85 km, which means that the number of sweeps within the preceding span should be at least

$$n = \frac{8083}{0.85} = 9{,}455 \text{ times}$$

As the scan breadth of the photograph is 457 mm, the fax receiver's scan line density should be

$$\ell = \frac{9455}{457} \approx 20.8 \text{ lines/mm}$$

So, this is how the minimum scan line density of the facsimile device is computed according to the size of the picture and the resolution of the photographed scene.

Second, the speed of the rotating drum in the facsimile device is determined according to the period of the satellite's orbit.

Each time the satellite circles around the earth, the number of scans needed to meet the resolution requirements is computed as follows

$$n_{total} = \frac{2\pi R}{0.85} = \frac{6.28 \times 6400}{0.85} = 47{,}050 \text{ times}$$

As the satellite's revolutionary period is 2 hours, the rotational speed N of the drum inside the facsimile device during the scanning process should be:

$$N = \frac{n_{total}}{T} = \frac{47050}{2 \times 60} \approx 400 \text{ RPM}$$

which is the primary scanning speed required to synchronize the facsimile and satellite scan.

The size of the drum is determined by the size of the picture, and its diameter is:

$$d = \frac{600}{\pi} \quad 192\text{mm}$$

Thus, the coefficient of cooperation (coefficient for preventing picture distortion) of the facsimile is:

$$\rho = \ell d = 20.8 \times 192 \approx 4{,}000$$

The various indices of the signal mode are determined by the satellite's transmission: The modulation mode is FM modulation; the carrier center frequency is 99 KHz; the frequency deviation is ±29 KHz; the highest modulated frequency is 35 KHz.

In addition, the overall designing of the facsimile system should incorporate such factors as the short life span of the satellite; the possibility of partial changes in some of the parameters of a newly launched satellite, which requires a certain degree of flexibility in ground stations so as to allow them to conveniently alter some variable parameters, such as the coefficient of cooperation, scan line density and drum rotation speed, etc.

2. Characteristics of Cloud Photographs

The difference between cloud chart facsimile and ordinary news telephoto systems lies in the fact that the former photographs all kinds of meteorological phenomena occurring either in the atmosphere or on the terrestrial surface. The phenomena are manifested by the pictures through shade, contrast and resolution. For a given scene, the shade and contrast varies with different scanning radiometers. For instance, the shades for various types of sceneries in visible light are as follows:

black: : sea, lake, large river

dark gray : vast areas of land vegetation and basalt soil region

gray : pastureland, grassland, farmland

gray white : desert, cloud zones with thin and small masses over the continent (fair-weather cumulus)

white : medium cloud (cirrostratus, altostratus, fog, stratus, cumulus), snow covered land in cloudless regions, frozen seas, lakes and rivers

bright white : large thick cloud masses, esp. cumulonimbus

In infrared radiometer photography, the shades are based on the temperature. The general law is: the higher the temperature, the darker the shade; the lower the temperature, the lighter the shade. As the temperature difference between the atmosphere and the earth's surface is only several tens of degrees, the contrasts are often relatively small in infrared pictures.

The terrestrial surface scene changes from season to season, and the surface temperature also varies from day to night, from winter to summer, as well as from south to north. All these factors can cause great contrast and shade differences to occur in the fax pictures. In order to pick up pictures that are useful and suitable for analytical processing, it is imperative to have the best available shade control circuit installed in the system, which allows the receiver to adjust to pictures of different regions and seasons, as well as pictures taken by various types of scanning radiometers.

Moreover, besides identifying sceneries from the different shades and contrasts in the fax cloud charts, it is also important to study the various kinds of physical processes in the atmosphere on the basis of cloud area, border shape, lamination, horizontal structure and vertical structure, and find the trend of meteorological development. Thus, it is most essential that the pictures are of very high resolution.

In sum, due to the characteristics of cloud layer sceneries and the uses of cloud charts, facsimile devices must be able to control the shade with flexibility, i.e., they must have shade control circuits to maintain an appropriate level of contrast in images from various types of radiometers. Lastly, the resolution must be fairly high. The slightest deficiency in any of the preceding links could very well affect the use value of the pictures.

3. On the Influence of the Doppler Effect

As cloud photographs are taken by orbiting satellites, there are some correlated factors that have to be taken into consideration. For instance, interruption, noise ratio, electric level fluctuation, etc, which occur in the course of reception. But the most important factor lies in the influence on synchronous scanning by the Doppler effect caused by the motion of the satellite in the first cosmic velocity.

As we know, to prevent distortion of the images, the facsimile system must maintain synchronous scanning during picture transmission. This is generally achieved by having both the receiver and the transmitter maintain scanning stability. The driving power frequency of the sychronous generator must be very steady. Generally speaking, the diurnal stability should be 10^{-8} in magnitude, which can be very easily achieved by high stability oscillators, such as quartz, crystal or tuning-fork oscillators. But in a cloud chart facsimile system, the pictures are transmitted from a satellite moving at the velocity of 7.8 km-sec. Thus, based on the principle of relativity, this is bound to give rise to beat frequency in the satellite's signals received by the ground station:

$$\frac{f_1 - f_0}{f_0} = \frac{vs}{c - v_s}$$

in which, f_0 is frequency received by the ground station when the satellite is stationary;

f_1 is frequency received by the ground station when the satellite is in motion;

v_s is the satellite's component velocity in the direction of the ground station;

c is the speed of light.

This is the Doppler effect. Now let us examine its actual influence. As the satellite passes through point A (Figure 2) v_s is at its maximum magnitude and can be approximately reckoned as follows:

$$v_{sA} = v = 7.8 \text{ km/sec}$$

As the satellite passes through point B, v_s is at its minimum magnitude, and can be regarded as approximately zero:

$$v_{sB} = 0$$

The respective values of the relative beat frequencies picked up by the ground station are:

$$\left.\frac{f_1 - f_0}{f_0}\right|_A = \frac{v_{sA}}{c - v_{sA}} = \frac{7.8 \times 10^5}{3 \times 10^{10} - 7.8 \times 10^5}$$

$$= 2.6 \times 10^{-5}$$

$$\left.\frac{f_1 - f_0}{f_0}\right|_B = \frac{v_{sB}}{c - v_{sB}} = \frac{0}{3 \times 10^{10} - 0} = 0$$

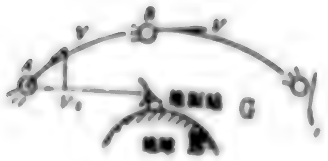


Figure 2

Key: G = ground station
E = the earth

As the satellite travels from point A to point B, the frequency variation is the geometric function of its flight path. Average values can be used to simplify calculation in engineering, i.e., when the satellite travels from A to B, the mean beat frequency value caused by the Doppler effect as the signals are picked up at the ground station becomes:

$$\left.\frac{f_1 - f_0}{f_0}\right|_{mean} = \frac{2.6 \times 10^{-5} + 0}{2}$$

$$= 1.3 \times 10^{-5}$$

The shift in picture recording caused by beat accumulation is:

$$\delta = TN\Delta\ell_{mean}$$

in which T is the facsimile scanning time as the satellite travels from point A to point B; N is the number of scans per minute; $\Delta\ell_{mean}$ is the recording shift per scan caused by the mean beat frequency, and it is obvious that

$$\frac{\Delta\ell_{mean}}{\ell} = \left.\frac{f_1 - f_0}{f_0}\right|_{mean} = 1.3 \times 10^{-5},$$

in which ℓ is the length of each scanning line.

Take the 121 fax receiver as an example: If T = 10 min, N = 400 rpm, ℓ = 600 mm, the preceding formula becomes:

$$\delta = 10 \times 400 \times 1.3 \times 10^{-5} \times 600 = 31.2 \text{ mm}$$

This means that due to the frequency beat produced by the Doppler effect, a 31.2 mm shift occurs in the fax pictures received by the ground station. Such a great synchronous error makes it impossible to position the pictures, which becomes practically useless. Thus, in a cloud chart fax system, it is imperative to compensate for the Doppler effect, and rectify the distortions caused by synchronous error.

Apart from the preceding characteristics, a cloud picture fax receiver should also be capable of picking up signals from various types of satellites (e.g. synchronous satellites, polar-orbiting satellites, etc). It should also be able to receive both positive and negative photo transmissions so as to adapt to the requirements of different generations of satellites. In designing a fax receiver, it is also important to allow certain parameters to be changed with relative ease. Besides, there are numerous other points which will not be discussed in this article.

The Work Principle of Cloud Chart Facsimile

Our country has developed two types of cloud fax receivers on its own: the 118 model and 121 model, which are manufactured by the Shanghai Wired Radio Plant. The 118 model is designed for receiving low resolution cloud pictures. The 121 receiver picks up high resolution cloud pictures. Their main technical indices are shown in Table 1.

Table 1

Model Technical parameter	118 Type	121 Type
Useful picture size	230 x 240 mm	457 x 567 mm
Scanning line density	6.6 line/mm 3.3 line/mm	20.8 line/mm 10.4 line/mm
Synchronous rotation speed	48 rpm 240 rpm	400 rpm
Drum size	diameter 80.6 mm length 250 mm	diameter 192 mm length 470 mm
Coefficients of cooperation	532, 266	4000, 2000
Resolution	imitation Song-Dynasty-style typeface No 4	imitation Song-Dynasty-style typeface No 6
Recording mode	photosensitized pos film recording	photosensitized pos or neg film recording
Signal mode	AM carrier freq 2400 Hz effective bandwidth: 2400 ± 1600 Hz	AM carrier freq 2400 Hz carrier center freq: 99 KHz max freq deviation: ±29 KHz max modulated freq: 35 KHz

Both systems employ drum scanning and photo-sensitized recording mode. Thus, their machinery structures are both composed of mechanical devices, optical systems and related electric circuits. They have basically the same working principle.

The mechanical device is the chief component for carrying out mechanical scanning and is composed of two parts. The first part is the main scanning portion which is made up of the main scan drive power source (high speed synchronous generator, gear box and revolving drum; the drum is driven by the generator and its speed is adjusted to the required rpm through the gear box; e.g. 48 rpm and 240 rpm for the 118 model, and 400 rpm for the 121 model. The main scanner should meet such requirements as steady rpm and excellent uniform speed characteristics. Generally, recording shifts caused by instantaneous occurrence of irregularities (due to vibration caused by mechanical factors) should be limited to within the range of 25-100 percent of the scanning line breadth, and the continuous variations of the rotational speed (i.e. recording errors caused by frequency drift in the synchronous motor) should be less than 10^{-6} in magnitude so as to prevent acute picture distortions caused by accumulated scanning shifts. Obviously, very strict requirements on the uniformity of the synchronous motor's rotational speed as well as the precision of mechanical installation. As the scanning line density, drum diameter and drum speed are increased, the requirements become even more stringent. The synthesis of vertical images is done by the main scanning portion.

The other part of the mechanical device is the secondary scanner, which is moved along a threaded rod by a drive source and controlled through a gear box. The screw-like threads are used for propelling the optical scanning system horizontally across the road in accordance with the required scanning line density, thus accomplishing the horizontal image synthesis.

Figure 3 shows the entire scheme of the mechanical scanning system.

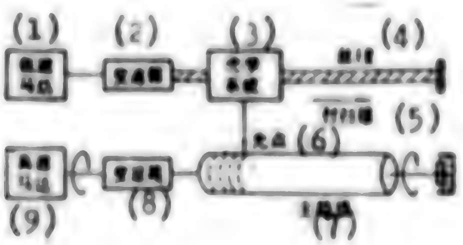


Figure 3

Key:

(1)	Low speed motor	(6)	Light dot
(2)	Gear box	(7)	Main scanner
(3)	Optical system	(8)	Gear box
(4)	Threaded rod	(9)	High speed motor
(5)	Secondary scanner		

Another important component related to the scanner is the optical system. The signal information which had been processed by electric circuits are reconverted by the optical system into video signals that correspond to the black/white variations of the original image. The video signals are converged by optical lenses and subsequently chopped up by optical aperture stops into spots of light corresponding to the densities of scanning lines. The spots are projected onto a photosensitive material (photographic paper or film) mounted on the spinning drum. As the mechanical device carries out its scanning task, the light dot progressively covers every spot on the photographic paper or film which records the picture image, thus completing the reception of the entire chart. The main requirements of the optical system are: high resolution, clear images, minimal aberration and spherical aberration. Moreover, the size of the light spot should be proportional to or slightly smaller in proportion to the scanning line density.

The electric circuits in cloud chart facsimile devices are designed for picking up and converting the signals as well as for insuring synchronous and in-phase scanning. Thus, they are generally composed of three main portions: receiver circuits, synchronous power amplifier circuits and auxiliary circuits--power source and control circuits.

The signal receiver circuit demodulates the high frequency signals picked up by the cloud chart facsimile receiver, and transforms them into the required video information which subsequently undergoes shade adjustment processing before being converted back into video signals by a video recording tube. This is the main portion of the receiver circuit. Besides, to achieve in-phase scanning, it also includes a phase tuning circuit through which the picked-up signals undergo synchronous separation to enable automatic in-phasing, and a lock-phase or lock-frequency circuit for rectifying the Doppler effect.

A synchronous power amplifier circuit is installed to insure synchronous scanning by the facsimile receiver and satellite radiometer. It provides a high stability frequency source for the synchronous motor. Based on the characteristic of synchronous motors, so as long as the frequency of the input signal remains constant, the motor speed also remains steady. Thus, in synchronous scanning, the stability of synchronous frequency should exceed 5×10^{-6}, to attain such a high degree of stability, the oscillators are generally made up of high Q-value materials, such as quartz crystal or bimetallic tuning fork. This is an important component of the synchronous power amplifier circuit. Besides, in order to give the spinning drum adequate mechanical power, the electric motor's driving signal must be maintained at a certain power level. This is achieved by installing a suitable motor which can adapt to various mechanical loads, as well as a power amplifier circuit for the projected driving motor. Generally, the motor power should be somewhere between several watts to tens of watts.

A cloud chart fax device not only has fairly strict requirements on cloud picture resolution shade and contrast, but also requires elimination of interferences caused by the Doppler effect. Thus, some of its circuits are similar to those used in ordinary telephotograph devices, and some are special circuits which are quite different. Following is a brief description of two relatively important circuits.

1. Dual Channel Shade Control Circuit

Recent models of meteorological satellites are designed to transmit visible ray pictures and infrared ray pictures simultaneously to meet the needs of the users. Visible ray radiometers and infrared ray radiometers can scan the terrestrial surface at the same time (180 degrees phase difference). Thus, the ground station can pick up two kinds of pictures at the same time. To adapt the 121 receiver to simultaneous reception of both kinds of pictures which require separate shade adjustment as well, a dual channel processing unit is installed in the receiver, thus enabling one receiver to satisfy the various specifications involved in the reception of two different types of fax photographs. Figure 4 is a block diagram of a dual channel receiver circuit.

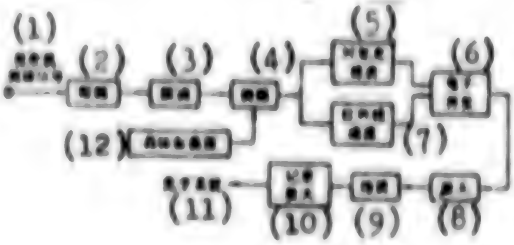


Figure 4

Key:
(1) Receiver FM signal
(2) Amplitude limiter
(3) Demodulator
(4) Amplitude modulator
(5) Visible ray channel
(6) Electronic switch
(7) Infrared ray channel
(8) Amplifier
(9) Detector
(10) Video recorder/amplifier
(11) Optical system
(12) Crystal oscillator

The receiver picks up a 1697 MHz signal which is converted into an FM full image signal through single demodulation and output to the fax unit. The receiver circuit of the fax device first submits the signal to a limiting amplifier which eliminates interferences and amplifies the signal to a suitable amplitude. Then, the signal is demodulated by the frequency-sensitive detector and low-pass filter, and subsequently transformed into a video signal. Through proper direct-current amplification, the video signal can be used to drive the video recording tube amplifier, thus completing the process of photoelectric conversion which produces the required video signal. But as the shade requirements in a fax system are especially stringent, and the slightest variation in the signal can affect the recording result, it is important to consider such factors as the zero drift in D.C. amplifiers. In addition, as the contents of cloud pictures vary with different seasons and regions, it is also imperative to have flexible means of adjusting the shades. Based on these two points, the 121 receiver is designed to demodulate an incoming signal and modulate its amplitude afterwards so as to convert the D.C. signal into an A.C. signal, which not only makes it possible to avoid use of D.C. amplification, but also enables adequate shade control.

To enable separate shade control over visible ray video signals, and keep them from interfering with each other, the shade control circuit is divided into visible ray channel and infrared ray channel, and the two independent units are controlled by an electronic changeover switch which allows them to rotate in sequence with the signal transmissions from the satellite. Following this stage, the signals share the same amplifier, detector and video recording tube amplifier.

The shade control circuits in the two channels are completely identical; both are composed of parallel black/white shade adjusting networks and related amplifiers.

2. Synchronous Frequency Automatic Lock-On Circuit

To eliminate the influence of the Doppler effect on cloud picture reception, a synchronous frequency automatic tracking circuit is installed in the cloud chart fax device. The purpose of this circuit is to change the mode of synchronism between the fax receiver and the satellite radiometer, i.e., instead of having an independent synchronous mode which allows each of them to maintain its own steady frequency, the circuit helps to set up a controlled-type independent synchronous mode which causes the synchronous frequency of the fax receiver to be controlled by the synchronous frequency of the satellite's scanning radiometer.

(1) The 118 system's automatic frequency lock-on tracking circuit--lock-on frequency circuit

The input of the 118 model is composed of 2400 Hz FM signals demodulated by the receiver. Due to the Doppler effect, beat frequencies occur in transmission signals when the satellite is in motion, which means that the ground station picks up signals already contaminated with variables caused by the Doppler effect.

The marking frequency of 118 model's synchronous power source is generated by a tuning fork type resonator, and its frequency is also 2400 Hz. THe fork resonator's frequency stability is approximately 5×10^{-6}, and the fine adjustment range can exceed it by one order of magnitude, i.e., 5×10^{-5}. This characteristic is ingeniously utilized by the automatic frequency tracking circuit in Figure 5.

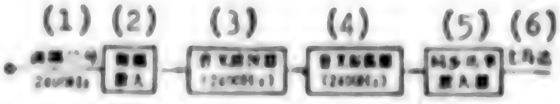


Figure 5

Key:
(1) FM signal 2400 Hz
(2) Limiting amplifier
(3) Fork filter (2400 Hz)
(4) Fork oscillator (2400 Hz)
(5) Synchronous power amplifier
(6) Main motor

Part of the picked-up signal is sent to the receiver circuit for processing and conversion, and the rest is passed on to the circuit in Figure 5. As the input FM signal is only 0-30 db, it has to be converted by a double-depth limiting amplifier into an undamped wave signal and subsequently submitted to a high Q-value tuning fork type filter (passband 2400 Hz ±1 Hz) which can remove noise signals and find the principal wave. The principal wave is a signal which contains beat frequencies "approximately" 2400 Hz caused by the Doppler effect. Based on the preceding calculation, its maximum relative beat frequency is 2.6×10^{-5}, which is smaller than the fine adjustment range of the fork oscillator. Thus, it can be used to force the frequency of the fork oscillator to vary according to the frequency of the satellite's scanning radiometer. This means that the fax system's synchronous frequency is not fixed at 2400 Hz; instead, it is locked onto the satellite's scanning frequency--this is why the circuit is known as lock-on frequency circuit.

The lock-on frequency circuit is only capable of adjusting the fax scanning synchronous frequency within the range of 5×10^{-5} order of magnitude. Due to the mechanical inertia of the fax system, it cannot possibly make greater adjustments. Thus, the fax system itself needs another synchronous frequency source of fairly high frequency stability. This type of frequency source also employs a fork resonator which is commonly used by ordinary telephoto devices as means of synchronism. This particular mode of synchronism is known as controlled independent synchronism because it is not only characterised by the element of being controlled, but also by the fact that it keeps a highly stable synchronous frequency source for its own use, which is different from compelled synchronism, as the latter is entirely controlled by external frequencies. When the satellite signal disappears, it can still keep on scanning without falling out of step: but as soon as the satellite signal is picked up, it becomes locked on while continuing to scan synchronously, which, in effect, insures the reliability of reception.

(2) 121 system's automatic frequency tracking circuit--lock-on phase circuit

In super high resolution picture reception, the center carrier frequency of FM signals is set at 99 KHz: with this type of signal mode, it is impossible to employ the preceding type of tracking method. Instead, the 121 receiver uses the lock-on phase method, and the block diagram of its circuit is shown in Figure 6.

The satellite's scanning radiometer transmits two types of initial scanning phase signals: one for infrared ray pictures, and the other for visible ray pictures, which enables the fax receiver to carry out phase adjustment. Obviously, by the time the ground station picks up the two kinds of signals, they have already been affected by the Doppler effect. Thus, the beat frequency components caused by the Doppler effect can be obtained by extracting the two kinds of signals.

As the two scanning radiometers in the satellite operate in synchronous mode, and our receivers are dual channel systems, it is thus possible to use any one of the two channels to tune into the satellite's initial scanning position. Synchronous scanning is achieved by changing the scanning phase of the ground station fax receiver in accordance with the phase signal.

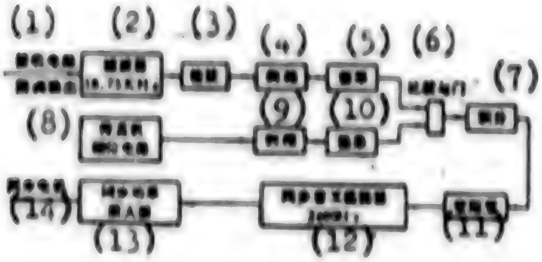


Figure 6

Key:
(1) Receiver circuit demodulation output
(2) Filter 18.75 KHz
(3) Detector
(4) Phase inversion
(5) Shaping
(6) AND-gate comparison
(7) Integration
(8) Fax phase circuit
(9) Phase inversion
(10) Shaping
(11) Variable resistance tube
(12) Synchronous fork oscillator 2400 Hz
(13) Synchronous power amplifier
(14) Synchronous motor

The 121 receiver can tune into infrared ray phase signals which are 18.75 KHz AM signals, the pulse width of which measures 1.7 ms. Such signals are transmitted together with the video signals, and can be extracted with 18.75 KHz narrow band filters, and using a detector to detect their envelopes. Although such phase signals can reflect the beginning of a main scanning line, their period is not fixed and constantly varies with the Doppler effect, which is unlike ordinary telephoto reception. This is why we use the phase signals as basis for adjusting the fax receiver's initial scanning position. The front of the pulse wave becomes relatively flat as it passes through a narrow-band filter. Further shaping of the waveform results in steep-frontal signal pulse measuring 3.3 ms wide.

At the initial point of each scan, the receiver's phase circuit also generates a pulse of its own to represent its initial scanning phase. The phase signal goes through similar shaping process, and is also converted into a steep frontal signal pulse with the same width.

Both the phase pulse of the receiver's initial scanning point and that of the transmitter's initial scanning point are passed onto an AND gate for comparison. When the phases agree, the pulses in both circuits reach the AND gate which outputs their matching portions. When the transmitter's phase signal is affected by the Doppler effect, the pulse width at the output end of the AND gate changes. The pulse continues on its way to an integrator which converts the pulse width variation into a direct current level variation. The magnitude of the level variation reflects the phase difference between the satellite's radiometer and the fax receiver during the scanning process.

The fax receiver's fork synchronous oscillator has a fine-adjusting potentiometer for correcting the frequency drift. The adjustment is done manually. The 121 receiver uses a transistor instead of a potentiometer. The internal resistance of the transistor is controlled by the direct current level at its base. The integrator's output D.C. level controls the base voltage which, in turn, can cause the transistor's internal resistance to change, thus regulating the synchronous fork oscillator's frequency. So as long as the oscillator frequency adjustment range exceeds the Doppler beat, automatic tracking can be achieved.

At present, there are two major areas of development in cloud chart facsimile: to improve its use value for picture analysis, and accelerate the process of turning out pictures. In the first area, new generations of satellites have been developed, such as the TAROS-N satellite which transmits data in the form of digital code signal; corresponding ground equipment can pick up the digital data signals, decode and convert them into analog information from which the pictures are produced and recorded. To accelerate the picture process, efforts are currently under way to enhance automation by automating the film developing process or employing the dry silver paper recording method which can instantaneously produce pictures through thermal developing process, which is very conducive to the acceleration of picture processing and enhancing the efficiency of meteorological prediction work.

9119
CSO: 4008

PUBLICATIONS

TABLE OF CONTENTS OF 'HUAGONG XUEBAO' NO 4, 1980

Beijing HUAGONG XUEBAO [JOURNAL OF CHEMICAL INDUSTRY AND ENGINEERING] in Chinese No 4, Dec 80 inside back cover

[Text] Carbon Deposition and Catalyst Deactivation of the Sb-Fe Oxide Catalyst for Ammoxidation of Propylene......Sb-Fe Oxide Catalyst Research Group, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences (299)

Method of Calculation of Extent of Solid Particles Reaction with Fluid in Continuously Stirred Tank Reactor......Li Zuohu [2621 0146 5706] and Chen Jiayong [7115 1367 6978], both of the Institute of Chemical Metallurgy, Chinese Academy of Sciences, Beijing (307)

Interphase Mass Transfer (I)--A Modified Surface Film Renewal Model......Shen Ziqiu [3088 5261 3061], Xu Weiqin [1776 4850 0530] and Ding Jie [0002 3381], all of the Dalian Institute of Technology (319)

A Study of Emulsified Liquid Membrane--Treatment of Phenolic Waste Water......Li Xinpei [2621 2450 1014] and Zhang Yuanqi [4545 0337 3823], both of the Dalian Institute of Chemical Physics, Chinese Academy of Sciences (333)

Study on the Isothermal Vapor Liquid Equilibrium of Acetic Acid-Water Binary over the Temperature Range 25-75°C...... Hu Ying [5170 5391], Wang Kun [3769 3824] and Lu Ruidong [0712 3843 2639], all of the Department of Basic Science, East China Institute of Chemical Technology (341)

Study on Vapor Liquid Equilibria for Three Binary Systems, Methyl Iodide-Methyl Acetate, Methyl Iodide-Methanol, Methyl Iodide-Acetic Acid, at Normal Pressure......Hu Wenli [5170 2429 0536], Chen Jinjin [7115 3160 3160], Liu Qingyuan [0491 3237 3293] and Xiao Zenglu [5618 1073 6922], all of the Southwestern Research Institute of Chemical Industry (353)

Kinetics on Epoxidation of Propylene with Ethylbenzene Hydroperoxide......Lu Naichen [7120 0035 1368], Li Guangfu [2621 0348 4395], Lu Yunzhi [7120 0061 6347] and Zhao Xujian [6392 4872 2914], all of the Institute of Chemistry, Shandong (365)

Liquid Side Mass Transfer Coefficients of Three Tower Packings Perforated Ring......Li Xiyuan [2621 6932 3293], Tan Qiu [6151 6669] and Li Ana [2621 7093 1226], all of the Chemical Engineering Department, Tianjin University (375)

Effect of Surface Roughness of Carbon Black on Reinforcement in Rubber......Wang Mengjiao [3769 1125 5754], Ge Xiongzhang [5514 7160 4545] and Qiu Jianmin [5941 1696 3046], all of the Research and Design Institute of Rubber Industry, Beijing (387)

Correlation among Concentration, Average Molecular Weight, Mooney Viscosity and the Physical Constants of Cis-polybutadiene Concentrated Solution......Shi Zijin [0670 1311 3866] and Tong Kejin [4547 0344 6930], both of the Department of Chemical Engineering, Zhejiang University (395)

Note

Convective Heat Transfer for Laminar Flow of Bingham Fluid through a Circular Tube......Zhuang Zhenwan [5445 7201 8001], Research Institute of Chemical Machinery, Lanzhou (405)

9717
CSO: 4008

TABLE OF CONTENTS OF 'HE JISHU' NO 6, 1980

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 6, 1980 preceding p 1

[Text] Advances in Radiation Polymerization......Liu Yuming [0491 6877 6900], Shanghai Research Institute of Chemical Industry (1)

Some New Progress in Nuclear Medicine......Zhao Huiyang [6392 1920 2254], Zhongshan Hospital, Shanghai First Medical College (8)

Parallel-Plate Avalanche Counter......Hu Wenxiang [5170 2429 4382], Liu Lianfan [0491 5114 3879] and Zhang Guilin [1728 2710 2651], all of the Shanghai Institute of Nuclear Research, Chinese Academy of Sciences (13)

The Performance of Three High Efficiency Packings Used in Isotope Separating Column......Yang Guohua [2799 0948 5478], Lu Weiguo [7120 4850 0948], Wang Rong [3076 5816] and Zeng Quanxing [2582 2938 5281], all of the Shanghai Research Institute of Chemical Industry (18)

Constant Fraction Timing Single Channel Analyzer......Xue Liudong [5641 6981] and Fang Yihong [2455 0001 3126], both of the Shanghai Institute of Nuclear Research, Chinese Academy of Sciences (23)

Thickness Measurements of Thin Layer and Foil by Using the Forward Scattering of 31.2 MeV Alpha Particles......Wu Junheng [0702 0193 1854], Zhang Daming [1728 6671 2494] and Wang Wenmin [3769 3774 3787], all of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences (27)

Model CS-101 Radioisotope Underground Water Detector--A γ-ray Activity Meter Used for Surveying Underground Water Source...... Wu Renchang [0702 0088 2490] and Li Jiasen [2621 1367 2773], both of the State-Run Jianan Instruments Plant (30)

A Method for Determining Settling Velocity of ^{113m}In Labeled Sands......Li Xiqi [2621 6932 4388] and Fan Xinshun [2868 2450 7311], both of the Institute of Hydrotechnic Research, Yellow

River Conservation Committee (34)

Absolute Measurement of Low Energy X-ray Exposure......Wu Quande [0702 0356 1795], Chinese Academy of Metrology (36)

The Use of the Coloring Effect of Polyethylene Film for Measuring Radiation Dose of ^{60}Co γ-rays or Electron Beams......Liao Yisong [1675 5065 2646], Zhang Yuefang [1728 2588 5364], Chang Xiuhong [1603 4423 3163] and Zhang Zicheng [1728 5261 2052], all of the Changchun Institute of Applied Chemistry, Chinese Academy of Sciences (41)

Separation of Thorium from Its Radiodaughters and Fission Products......Cheng Yuandi [2052 3293 2769] and Xue Zhilun [5641 4363 4858], both of the Shanghai Institute of Nuclear Research, Chinese Academy of Sciences (43)

The Distribution of [2, 5, 6-^{3}H]-DL-DOPA in Adrenals and Melanoma of Mice......Sun Qixun [1327 4388 5651] and Wang Yongchuan [3769 3057 1557], both of the Shanghai Institute of Nuclear Research, Chinese Academy of Sciences (45)

Experiment of Lymphocyte Transformation with ^{3}H-TdR--A Study of a Method of Sample Preparation......Yang Xizhen [2799 1585 7201], Wu Jiaping [0702 0163 1627] and He Rongxia [0149 2873 7209], et al., all of the Jiangsu Institute of Nuclear Medicine, Wuxi (48)

9717
CSO: 4008

PUBLICATIONS

TABLE OF CONTENTS OF 'KEXUE HUABAO,' JANUARY 1981

Shanghai KEXUE HUABAO [SCIENCE PICTORIAL] in Chinese No 1, Jan 81 p 48

[Text] Table of Contents

Whole Life Talent Design: From Birth to Eighty--
Xu Liyen [6079 4539 6056].. (1)

Modernization

Electronic Computer Invaded the
Field of Classical Literature--
Zhou Jiajun [0719 4471 7486] and
Yu Xiaoli [0080 1420 7787]... (2)

Star 80--The Garbage Processing Plant--
Wei Jiayu [7614 1367 7183]... (4)

Spy War in the Space Age--
Qi Xie [7871 0588]... (4)

1986: Last Rendezvous of the Century--
Ye Huimin [5509 1920 3046] and
Yan Wanyi [7346 8001 0310]... (6)

The Second Pair of Legs for Paralyzed Patients--
Lin Ersong [2651 1422 2646].. (6)

Nature and Society

Commercial Products and Market Prediction--
Chen Liangqiang [7115 6647 1730]... (8)

Automobile War Between Japan and United States--
Chen Lianqiang [7115 6647 1730].. (10)

Crime Psychology--
Tien Peiming [3944 1014 2494].. (12)

Mr X (-ray), the New Investigator--
Chen Zhixiang [7115 1807 4382].. (18)

Napoleon, Spiders and the Electronic Computer--
Translated and compiled by
Fang Zihan [2455 1311 3352].. (30)

Blood Types Revisited--
Liao Yang [6697 3152]... (26)

Health Care of the Elderly--
Zhu Hongren [2612 3163 0088]... (28)

A Visit to the Chengdu Tongrentang, A
Drugstore for Revitalizing Tonic Diet--
San Bo [0005 3134].. (11)

Scientific Achievements of 1980 Novel Laureates

Powerful Tool for Reshaping Life--
Tang Jinyan [3282 6930 3508] et al..................................... (24)

Unveiling the Mystery of Organ Transplants--
Xu Yiping [6079 0110 1627]... (24)

The K-meson Controversy--
Zhou Minyao [0719 2404 5069]... (24)

Outpatient Doctor

The Wonders of the Medicine Pillow..................................... (14)

Sexuality of Infants.. (14)

Menopause Symptoms in Men... (14)

Diabetic Heart Disease and Thyroidal Heart Disease..................... (16)

Can Breast Feeding by Retarded Mother Lead to Hereditary Retardation?.... (16)

Science Fiction

The World's First Science Fiction--
The Story of Frankenstein--
Chen Yuan [7115 3220]... (42)

Mary Shelley and her Dr Frankenstein--
Chen Yuan [7115 3220]... (42)

The Mysterious Black Medicine Case--
Translated and edited by Li Duanhua [2621 4551 5478]...................... (44)

The World of Books

Window of the World--Introducing the "World Book" .... (43)

Recommending the "College Mathematics Self-Learning Series"--
Xu Fusheng [1776 4395 3932] .... (37)

Tidbits of Science

Inspiration of Artists .... (32)

The Inverted Portrait .... (32)

The Time Bomb in Our Bodies .... (33)

Unusual Sleeping Habits .... (33)

The Most Sleepy Person .... (34)

Submarine That Flies .... (34)

Scientific Research as a Chess Game .... (34)

Brain Exercises .... (36)

- Coded Mathematics
- Test Your Vision
- The Jumping Frog
- Which Way Does the Iron Ball Fall?

Science Advisor .... (38)

- How To Receive Channel 20 Programs
- How To Build UHF Antenna
- How To Select Cassette Tape
- How To Use Magnetic Tape Correctly

The Why's .... (40)

- Why Does Some Gasoline Have Yellow or Red Color?
- Why Are Alkaline Soaps Not Suitable for Washing Fabrics That Have Gold and Silver Threads?
- Why Can a Blindfolded Owl Still Catch a Mouse?
- Why Is It Not Good To Store Cooking Oil in Plastic Containers Over Extended Period of Time?
- Why Is the Blood Blue in the Vein?
- Why Is the Number of Jewels in a Watch Always Odd and Never Even?
- Why Does Gastric Ulcer Pain Often Occur After a Meal Whereas Duodenal Ulcer Pain Occurs Before a Meal?

Why Are Loud-Voiced Conversations in a Telephone Hard To Hear?
Why Is It Not Necessary To Check Blood Type Before Transfusion in Livestock?
Why Is the Mimosa Not So Shy Before It Rains?

Brief News in Science and Technology.. (20)

China's First Focused-Light Solar Cell Array Successfully Developed
High Speed Photoacoustic Spectrometer
Super-Long Fluorescent Tubes
Alloy Material That Eliminates Noise
A New Coloring Agent for Plastics--Concentrated Color Particles
An Automatic Rapid Germination Machine
Metals That Absorb Gases
New Material for Wrapping Foil
Magnetic Dye
Vaccine for Type B Hepatitis
Thin Film That Changes Color Now Used as Optical Display
Miniature Printer
Rust Removal With Microorganism
Oil Tanker With Sails
Treating Obesity With Ear Acupuncture
Multiple-Purpose Gloves
Gas-Pressure Alarm Clock
Strange Phenomena on Saturn

Front Cover : Aishi [1947 0169] Brand Radio-Frequency Testing Equipment

Inside Front Cover: Whole Life Talent Design--From Birth to Eighty

Inside Back Cover : Zirconium Dioxide Products of Shanghai 51 Chemical Plant

Back Cover : Aishi [1947 0169] Brand Radio-Frequency Testing Equipment

9698
CSO: 4008

AUTHOR: ZHANG Xinbo [1728 2450 3134]

ORG: None

TITLE: "Engineering Calculation of the Ambiguity Function of Radar Signals"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 1-9

TEXT OF ENGLISH ABSTRACT: A generalized relationship for calculating the ambiguity function of radar signals is derived, which can be used to calculate any complex signal by layer-by-layer repetition and multiple modulations. A linear FM rectangular envelope sub-pulse is taken as an example of the component signal. The relationship derived is widely applicable in many cases, such as a single pulse and the coherent pulse trains, linear FM in the pulse duration, frequency and phase shift coding of the contiguous sub-pulses, staggering the repetition period and interpulse frequency shift, complex weighting of the pulse trains and so on. An ALGOL program and its practical application was given by the author in another paper.

AUTHOR: CHEN Jinghua [7115 2529 5478]

ORG: None

TITLE: "Harmonic Distribution Winding and Linear Rotatory Transformer"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 10-18

TEXT OF ENGLISH ABSTRACT: In this paper a new type winding of electrical machines, harmonic distribution winding, has been presented. This technique differs from the conventional one and it purposefully makes use of the harmonic field in the air gap generated by this winding for harmonic compensation or approach. In many applications it has been proved that the limit of linearity in linear rotatory transformers may be broken by means of this winding and the linearity may be held on grade 0 (± 0.055% or ± 2'), and in some products even up to ± 0.02% or ± 45". In this paper the theory of this new winding and error regularity of these machines have been analyzed and test results are provided.

AUTHOR: YANG Shizhong [2799 1102 0022]

ORG: None

TITLE: "Performance Analysis of Frequency Analyzer in Acquisition Receiver under Noise Environment"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 19-28

TEXT OF ENGLISH ABSTRACT: In this paper the performance of a type of frequency analyzer under white Gaussian noise distribution is discussed. The frequency analyzer is an essential part of the acquisition receiver in precision tracking systems. The analyzer we developed is of the type of multiple current switched logic circuit with weighted resistance network. The points, which are investigated with emphasis, are as follows: (1) The selection of the optimal threshold of signal detection. (2) The false alarm and miss probabilities in multiple channels with unequal bandwidth. (3) The influence of noise on the analyzer output. (4) The performance of the analyzer under more generalized conditions, that is, when the input is a set of spectrum lines.

It is shown that our analyzer has the ability to guide the receiver to lock on the carrier even when the carrier amplitude is smaller than that of the subsidiary lines of subcarriers.

AUTHOR: CI Yungui [1964 0061 2710]

ORG: None

TITLE: "The Reliability Analysis of a Large Computer System"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 29-42

TEXT OF ENGLISH ABSTRACT: In this paper the reliability of a large-scale general purpose computer system (151-3/4) is analyzed in detail. Some basic parameters, such as MTBF (mean time between failures) and λ (rate of failures per unit time) of reliability of the whole system, subsystems and integrated circuits, etc., are statistically determined. The formulas of reliability calculations are derived. The reliability design, calculations and predistribution are worked out in steps. Various experiment items and quality control of production are described simply.

AUTHOR: HUANG Dexing [7806 1779 2502]

ORG: None

TITLE: "A Magneto-Sensitivity Theory of Double Injection Long Diode"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 43-52

TEXT OF ENGLISH ABSTRACT: In this paper a magneto-resistance effect of the double injection long diode with the introduction of a high recombination center on one of the lateral surfaces is studied based on the two-dimensional equation. The general relationship among the carrier effective lifetime, J-V characteristics and the magnetic field is clarified, the magneto-sensitivity is established, and their approximate expressions in a strong or weak field are given as well. Finally, the theory is compared with the experimental curve and data of Germanium-magneto-diode. The results indicate that the theory agrees with the experiment.

AUTHOR: FAN Desen [2868 1795 2773]

ORG: None

TITLE: "An Approach to Numerical Analysis of Microstrip Type Transmission Lines"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 53-59

TEXT OF ENGLISH ABSTRACT: From the viewpoint of field sources, the electromagnetic field problem of microstrip type transmission lines is treated by using a generalized method of "computer analogy of electrostatic induction process." The calculable physical quantities are: distribution of charge and current, characteristic impedance, phase wavelength, losses in conductors and dielectrics, etc. As an example of applications, the calculated results of standard microstrip lines are presented. The accuracy of calculation which is high enough for practical purposes is illustrated.

AUTHOR: BAO Yushu [7637 3768 2579]

ORG: None

TITLE: "Studies on the Filtration of H^o_{21} Mode in H^o_{11} Circular Waveguide"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 60-67

TEXT OF ENGLISH ABSTRACT: In orthogonally polarized H^o_{11} multi-mode circular waveguide systems, filtration of several lower high-order modes, such as E^o_{01} E^o_{11}, has been treated favorably. However, no report on further research in the filtration of higher-order modes, such as H^o_{21}, has so far been revealed. In this paper, operational principle and design scheme of an H^o_{21} mode filter are dealt with, an approximate formula for determining mode coupling quantities according to Bethe's small holes diffraction theorems is derived, and methods for computing mode attenuations for cascaded multicavity filter and reflection characterists of the dominant mode are proposed. The experimental results have checked well with the theoretical analysis and design formulas; the transmission characteristics of the dominant and higher-order modes are perfectly satisfactory.

AUTHOR: SUN Fuchuan [1327 1788 1557]
YANG Runcai [2799 3387 2088]
DAI Shuping [2071 2885 1627]

ORG: None

TITLE: "Extraction of Image Information from Heavy Background Interferences--Image Processing by Simulating the Principle of Visual Lateral Inhibition"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 68-72

TEXT OF ENGLISH ABSTRACT: The "Lateral Inhibition" is a general phenomenon existing in the visual nural system. The image contour information can be extracted by means of an electronic network simulating the "Lateral Inhibition" function. The principle and method are described in this paper. The frequency response of the simulating electronic network is also discussed. It would be useful for observation and recognition in some electro-optical systems.

AUTHOR: ZHANG Dehong [1728 1795 1347]
CHEN Guizhang [7115 2710 4545]
ZHOU Biru [0719 4310 1172]

ORG: None

TITLE: "The Multilayer GaAs Epitaxial Growth Technique in a Reactor of Two Chambers"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 73-78

TEXT OF ENGLISH ABSTRACT: This work presents the growth apparatus of VPE multilayer GaAs and outlines the experimental technique and some results of experiments for preparation of multilayer GaAs layer in a reactor of two chambers. The feature of this technique is to avoid the storage effect. Three sorts of layers have been prepared for microwave device applications. Using these materials, we have obtained a 144 mW output power with 3.84 percent efficiency at 56.5 GHz, a noise figure of 2.4 dB with an associated gain of 6.5 dB at 9.3 GHz, and a continuous power output of 3 W with 20.2 percent efficiency at 8.57 GHz for the Gunn diode, FET and IMPATT diode respectively.

AUTHOR: LI Qihu [2621 0796 5706]

ORG: None

TITLE: "A Simple Method for Calculating the Output of Multilayer Correlator"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 79-81

TEXT OF ENGLISH ABSTRACT: The correlator model considered in this paper is suitable for any kind of multilayer correlator, including polarity coincidence correlator and analogue correlator.

A simple calculation method of the output of a multilayer correlator is given. In a certain sense there exists an optimum threshold for layer operation, and the theoretical analysis and practical evolution are presented.

AUTHOR: CHEN Xianglong [7115 5046 7893]

ORG: None

TITLE: "Electronic Smoothing Filters"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 82-86

TEXT OF ENGLISH ABSTRACT: A new network model of an electronic smoothing filter is proposed and it is proved that this model has an ideal smoothing factor approaching infinity theoretically. In the experimental circuits, both the reverse-connected composite mode of the transistor and the positive grid characteristics of the vacuum-tube are used. Therefore, the filtering function of the electronic devices is performed to the fullest.

The results of the experiments show that the smoothing factor of the transistor filter may reach 11000 and the smoothing factor of the vacuum-tube filter may reach 2300.

AUTHOR: TIAN Yongzheng [3944 3057 2973]

ORG: None

TITLE: "Comment on the Formula for Determining the Acquisition Range of a Phase-locked Loop"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 87-90

TEXT OF ENGLISH ABSTRACT: Lindsey's derived formula for determining the acquisition range of a phase-locked loop is

$$\frac{\Delta\omega_0}{K} = \frac{\Omega}{K} + \left[\frac{K a(\Omega)\tau_2}{2\Omega\tau_1}\right]\left[\cos\varepsilon(\Omega) - \frac{\sin\varepsilon(\Omega)}{\Omega\tau_2}\right]$$

This seems to be erroneous and must be corrected as

$$\frac{\Delta\omega_0}{K} = \frac{\Omega}{K} + \left[\frac{K a(\Omega)\tau_2}{2\Omega\tau_1}\right]\left[\cos\varepsilon(\Omega) + \frac{\sin\varepsilon(\Omega)}{\Omega\tau_2}\right]$$

In this paper, the corrected formula is derived and its correctness is proved from the view of the physical concept.

AUTHOR: LI Yuanwen [2621 6678 2429]
MA Xiangping [7456 4161 1627]

ORG: None

TITLE: "The Filter Using Simulated Inductors"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 91-94

TEXT OF ENGLISH ABSTRACT: In this paper two types of low loss simulated inductors are described. Their application to the realization of filters and a simplified method for their adjustment are presented. Design examples are also given. It is shown in practice that simplicity, stability, low cost, ease of adjustment and very good response to temperature variations are among the major features of the filters, thus they are suitable for engineering applications.

AUTHOR: ZHENG Xuemeng [6774 1331 1322]

ORG: None

TITLE: "Characteristics of the Hybrid-Ring for Arbitrary Power Distribution"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese No 4, 1980 pp 95-99

TEXT OF ENGLISH ABSTRACT: A coaxial hybrid-ring (four-terminal pair network) can be simplified to a two-terminal pair network. Its scattering matrix and design formulas under the conditions of arbitrary power distribution are derived. The experimental results [illegible] agree with the theory are also given. Compared with other directional [illegible] the hybrid-ring provides the advantages of simplicity and accuracy in design.

9717
CSO: 4009

AUTHOR: WANG Peilun [3769 0160 4858]

ORG: None

TITLE: "Robustness of Kinescope Glass Shell"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 1-13

TEXT OF ENGLISH ABSTRACT: The problem of robustness of the kinescope glass shell is discussed in detail in this paper. First, the main causes of explosion of the glass shell are analyzed. The author points out that the robustness of the glass shell depends on the distribution of residual stress and that of structural stress in the shell. Experimental methods for determining the residual stress and structural stress in the glass shell are described. The problem of stress concentration caused by the air bubble in the shell is discussed. A tentative idea of how to use the fracture mechanics method to study the effect of macroscopic defects of the glass shell is proposed. Finally, the principles of design for preventing explosion of the kinescope glass shell are presented.

AUTHOR: LIU Bingkun [0491 3521 0981]
REN Jiasheng [0117 1367 3932]
CUI Xiuhua [1508 4423 5478]
MA Dayin [7456 1129 7299]

ORG: None

TITLE: "An Experimental Study of the ZDB-150 Type Cryogenic Vacuum Pump with Closed-Cycle Refrigerator"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 14-22

TEXT OF ENGLISH ABSTRACT: Cryogenic pumping represents the latest method in high and ultra-high vacuum-obtaining techniques. It has the advantages of high pumping speed, freedom from hydrocarbon-contamination, and adaptability to a wide range of operating pressures. This paper deals with the design concepts, the actual construction and the main performances of the ZDB-150 type cryopump. In the free molecule flow region the pumping speed is greater than 650 l/sec and 1400 l/sec for air and hydrogen respectively. The ultimate pressure is less than 6×10^{-10} torr. The two-stage G-M closed-cycle refrigerator provides 2.5 watts at 15 K for the second stage and 25 watts at 70 K for the first stage. A comparison between the performances of the ZDB-150 cryopump and some other commercial types is listed at the end of this paper.

AUTHOR: HUANG Qiwen [7806 0796 2429]
ZHANG Mingbao [1728 2494 1405]
WANG Zongjin [3769 1350 6651]

ORG: None

TITLE: "Investigation of a Long-Life CO_2 Laser with $CaCO_3$ as Supplier"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 23-28

TEXT OF ENGLISH ABSTRACT: This paper describes the problem of using $CaCO_3$ as a supplier of CO_2 to compensate for its loss by dissociation and thereby prolonging the lifetime of a CO_2 laser. The relation between the equilibrium pressure of $CaCO_3$ and the laser output characteristics is also investigated.

AUTHOR: SHA Yujun [3097 3768 6874]

ORG: None

TITLE: "A General Analytic Method of Solving Mixed Lumped-Distributed Networks"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 29-42

TEXT OF ENGLISH ABSTRACT: In this paper the uniform transmission line is considered as a four-terminal element, and the formula for its Y-parameters against the external circuit is derived. Using these parameters, the author suggests a general analytic method of solving the mixed lumped-distributed networks, and a transmission line transformer is taken as an example of its application. The result thus obtained gives a theoretical explanation of the wideband characteristic of the transmission line transformer.

AUTHOR: YING Jimin [2019 3444 3046]

ORG: None

TITLE: "A New Approach to the Helix Dispersion Equation for Longitudinal Loading by Radial Vanes"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 43-56

TEXT OF ENGLISH ABSTRACT: This paper gives a new approach to derive the helix dispersion equation for longitudinal loading by radial vanes and also gives the helix dispersion equations for two specific loading structures. The calculated values by this method agree satisfactorily with the experimental results.

AUTHOR: FENG Chunbo [7458 4783 0130]

ORG: None

TITLE: "A Computational Method for Stability Analysis of Linear Control Systems"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 57-61

TEXT OF ENGLISH ABSTRACT: A computational method for stability analysis of linear control systems is presented. The state-variable matrix of a linear system is first transformed into an equivalent upper Hessenberg matrix. This reduction of the system matrix to Hessenberg form may be achieved by the use of either stabilized elementary matrices or elementary unitary matrices. The upper Hessenberg matrix is then transformed into a Schwarz matrix. The stability of the system is analyzed on the basis of the well-known property of the Schwarz matrix. The suggested method is also useful for computer-aided feedback synthesis of multivariable linear control systems.

AUTHOR: SHI Mingheng [2457 2494 1854]

ORG: None

TITLE: "Differential Equations of Intense Heat and Mass Transfer in Capillary-Porous Medium"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 62-68

TEXT OF ENGLISH ABSTRACT: The study of heat and mass transfer in a capillary-porous medium is extended to the case where liquid and vapor are transferred simultaneously. A system of differential equations is set up for this case.

AUTHOR: YIN Kaitai [3009 7030 3141]
WANG Zhong [3076 1813]

ORG: None

TITLE: "Design and Operation of Submerged-Combustion Evaporator"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 69-79

TEXT OF ENGLISH ABSTRACT: This paper is a summary on the design and operation of a submerged-combustion evaporator. This technique can attain three aims: to recover the spent hydrogen to be used as fuel for evaporation; to raise the concentration of NaOH liquor; and to recover the exhaust gas, which is relatively pure nitrogen, to be used as protective gas. This useful technique has not been widely adopted in China because of the lack of safety measures.

In this paper the condition of stability of the submerged combustion and the factors causing explosion are analyzed. A design principle to reduce the pressure fluctuation and some safety measures against explosion are proposed.

AUTHOR: SONG Yatong [1345 7161 2717]

ORG: None

TITLE: "Research on Artificially Generated Earthquake Records"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 80-89

TEXT OF ENGLISH ABSTRACT: In this paper, a survey is made of the research work on artificially generated earthquake records. For structural design purposes, the author proposes a method of creating artificial earthquake acceleration-time records which are compatible with a given smooth design spectrum, and develops a corresponding computer program. This presupposes that the ground motion in earthquakes consists of a linear combination of various harmonic motions with stochastic phase angles. The amplitudes of the Fourier spectrum are then modified step-by-step until the amplitudes of the response spectrum of the artificially generated earthquake record match the given design spectrum most closely. The resulting artificial time records are representative of the given earthquake intensity and design spectrum, and will provide a reliable basis for the aseismic design of important engineering structures.

AUTHOR: DING Dajun [0002 1129 6874]

ORG: None

TITLE: "Discussions on Some Problems in the Design of Masonry Structures"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 90-104

TEXT OF ENGLISH ABSTRACT: In this paper the author gives his opinions on several problems in the Design Code of Masonry Structures GBJ 3-73.

For the influence coefficient of eccentricity (eccentricity coefficient), the author endeavors to offer some theoretical explanation and makes an investigation on the possibility of improvement. For the computational height (effective length) of a wall supported on four sides, he suggests a set of three consistent formulas. For the calculation of bearing (on partial area), he gives some practical proposals based on recent test results in this country.

AUTHOR: WU Mingwei [0702 2494 0251]

ORG: None

TITLE: "On the Layout of Urban Industry"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 105-112

TEXT OF ENGLISH ABSTRACT: Based on a survey of the present status in our city-planning practice, the author gives a preliminary summary of the problems concerning the overall arrangement of urban industry in China. The article consists of four parts: the structure of urban industry, the types of distribution of industries, the organization of the industrial district and the layout of the small local industries.

The author advances some views on the relationship between the economic arrangement and urban planning, and the relationship between the structure and the layout of industries. The method of organizing the industrial district, the correct attitude toward the small industries and their layout are also discussed.

AUTHOR: GAN Cheng [3927 2906]

ORG: None

TITLE: "How to Improve the Thermal Stability of the Light Exterior-Protected Construction of an Air Conditioned Room"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 113-120

TEXT OF ENGLISH ABSTRACT: This paper shows that it is incorrect to specify the thermal stability of an exterior-protected construction by its index of thermal inertia, and that the thermal stability rather depends upon its decrement factor and characteristic time. The means of improving the thermal stability of a light exterior-protected construction of an air conditioned room are pointed out.

AUTHOR: None

ORG: Underwater Acoustic Bionics Research Team

TITLE: "Animal Transmissive Window--Acoustic Measurement of the Lipotes vexillifer Melon"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 2, 20 Jun 80 pp 121-127

TEXT OF ENGLISH ABSTRACT: From the angle of bionics of the animal sonar system, this paper discusses the function of the acoustic lens of the melon of Lipotes vexillifer. Based on the theory of the dome of the underwater transducer, we make the following suggestions:
(1) The density (ρ) and the acoustic wave impedance of the melon can be changed so as to get the maximal transmission of energy for the emission of different kinds of signals.
(2) The shape and curvature of the melon can be changed so as to get the necessary pattern of emitted beam in the dolphins' locating, communicating and hunting activities.

The second part of the paper describes the preliminary results of a measurement of the acoustic characteristics of a piece of the melon of Lipotes vexillifer.

9717
CSO: 4009

AUTHOR: YE Juhua [5509 5468 5478]

ORG: None

TITLE: "Zhan-Yuan Garden"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 1-22

TEXT OF ENGLISH ABSTRACT: In the Ming Dynasty the garden was a part of the palace belonging to the famous general Xu Da. Later, it fell to ruin. In the early 60's, the author took part in its restoration. This paper gives a survey of the history, characteristic features, artistic value of the garden and a description of the plan of restoration.

AUTHOR: LIU Guanghua [0491 0342 5478]

ORG: None

TITLE: "Building Groups, Spaces and Their Sequence"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 23-34

TEXT OF ENGLISH ABSTRACT: Building groups, spaces and spatial sequence give a definite shape to urban spaces, but the aim of an urban space is to arrange and support the physical environment of human behavior and to create a specific form which is both functional and aesthetic.

The first part of this article deals mainly with the idea that the city is constructed according to the needs of its inhabitants. City spaces are social centers which should be designed according to the will of those who live in them and to their behavior pattern.

The second part focuses attention on the sequence of building groups. Classical Chinese architecture ensembles command our admiration because they continue to have a positive meaning in today's urban design. In analyzing the experience of sequence in these building groups and the great plasticity and metaphorical form which they embody, we can rediscover aspects of architecture in general which are today too easily forgotten, and they help to create new urban forms to fulfill the requirements of our social life.

AUTHOR: PAN Guxi [3382 6253 6007]

ORG: None

TITLE: "Preliminary Comment on 'Ying Zao Fa Shi'"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 35-51

TEXT OF ENGLISH ABSTRACT: This article deals with the relation between "Ying Zao Fa Shi," the famous classic on Chinese architecture, and the traditional architecture in south China. It also deals with the limitation of the contents of the book and with the classification of the feudal building in the Song Dynasty.

AUTHOR: WEI Zhaoji [5898 0340 7535]

ORG: None

TITLE: "Visual-Quality Distance--A Complex Visual-Quality Criterion of Seats in a Gymnasium"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 52-60

TEXT OF ENGLISH ABSTRACT: Based on a survey of the choice of seats by the audience in a gymnasium together with some mathematical analysis, the author suggests that a new criterion with a single index, the visual-quality distance, may be used to characterize the visual-quality of seats in a gymnasium. The use of a single index makes it possible to make a direct comparison of visual-quality between different seats in a gymnasium or between different gymnasiums.

AUTHOR: WANG Zhengxian [3769 2398 6343]
LAI Dingwen [6351 1353 2429]

ORG: None

TITLE: "Analysis on the Overvoltage Caused by the Saturated Characteristic of Potential Transformers in a Power System (II)"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 61-84

EXCERPT FROM ENGLISH ABSTRACT: The mathematical model of a simulation test is a differential equation of order 6, with a nonlinear oscillatory form as follows:

$$\frac{dx}{dt} = A_1 x + g_1(t,x)$$

This paper presents proofs for four related theorems.

AUTHOR: QIAN Linqun [6929 7207 5028]

ORG: None

TITLE: "Relation between Mittag-Leffler Theorem and Driving Point Function Z(s) of Single Port Networks"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 85-92

TEXT OF ENGLISH ABSTRACT: This article deals with the application of the Mittag-Leffler theorem to the positive real and rational function Z(s). If Z(s) contains poles on the jw axis only, then from the M-L theorem we can derive the following formula:

$$Z(s) = \frac{k_{0,1}}{S} + \sum_{i=1}^{(m-1)/2} \frac{2k_{i,1}S}{S^2+\omega_i^2} + \left[Z_1'(0) - \sum_{i=1}^{(m-1)/2} \frac{2k_{i,1}}{\omega_i^2} \right] S.$$

AUTHOR: SHEN Chuyu [3088 2806 3768]
SUN Zhongliang [1327 1813 5328]

ORG: None

TITLE: "Analysis and Design of Microwave PIN-Diode Array Attenuator"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 93-102

TEXT OF ENGLISH ABSTRACT: In this paper the PIN-diode array type attenuator is analyzed by means of a normalized [A] matrix, and the design curves for 4-6 diode equi-element array and for exponentially varying array as calculated by means of a computer are given. Their accuracy is higher than that computed according to the image method. A special program is also worked out for the analysis of an inductive compensating array. Characteristics of various inductive compensating arrays may be conveniently analyzed with the help of an array factor.

AUTHOR: CAO Shichang [2580 0013 2490]

ORG: None

TITLE: "Finite Element Analysis of Field in a Coupled Cavity with a Diaphragm"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 103-110

TEXT OF ENGLISH ABSTRACT: In this paper the electromagnetic field distribution in a coupled cavity with an apertured metallic diaphragm is analyzed by the finite element method. This type of cavity is used as the slow-wave structure of a high-power traveling wave tube. Several equations that may be solved by a high-speed digital computer are derived. The method may also be applied to other types of cavities which are resonated in the TM_{010} mode.

AUTHOR: SHEN Zhengyuan [3088 2973 0337]

ORG: None

TITLE: "Waveform, Sequence and Shift Counter Synthesis--Realization of Synchronous Frequency-Division by Means of Shift Counter"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 111-118

TEXT OF ENGLISH ABSTRACT: In this paper, synthesis of a shift counter based on the principle of feedback shift register by means of binary periodic sequence generation is discussed. Feedback functions are derived by means of which the shift counters with variable phase shift, variable pulse width and variable frequency-division coefficient can be produced.

The author used the method of state-transition transformation to prove that with such feedback functions the shift counters are capable of generating the desired binary periodic sequence, and that they have self-starting ability because their state diagrams show only one cycle with branches.

The sequence combination method is also discussed, and it is pointed out that this method is very suitable for generating pulse trains having two or more pulse durations simultaneously.

AUTHOR: ZHAO Aosheng [6392 2407 3932]
LIU Zengtang [0491 1073 1016]

ORG: None

TITLE: "Development of a Continuously Working Wear-Testing Apparatus"

SOURCE: Nanjing NANJING GONGXUEYUAN XUEBAO [JOURNAL OF NANJING INSTITUTE OF TECHNOLOGY] in Chinese No 4, 20 Dec 80 pp 119-125

TEXT OF ENGLISH ABSTRACT: In this paper, the working principle, structure and actual performance of the continuously working wear-testing apparatus are described. Particular attention is paid to the inductive transducers and their characteristics as compared with other techniques. The test data proved the reliability of the test apparatus.

9717
CSO: 4009

AUTHOR: HE Guangsheng [6378 0342 3932]

ORG: Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Mode Restriction Characteristics of Metastable Optical Resonators"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 1-6

TEXT OF ENGLISH ABSTRACT: The classification concepts and operational conditions for metastable resonators are given by using the geometric-optics theory. The mode discrimination and restriction characteristics of the principal two-element metastable resonators (such as parallel-plane, imaginary concentric, real concentric and various g cavities) are analyzed. Some problems concerning practical applications of metastable resonators are discussed in conclusion.

AUTHOR: None

ORG: Group 105, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Experimental Investigation of Aerodynamic Windows"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 7-12

TEXT OF ENGLISH ABSTRACT: This paper describes the design and experiments of three types of aerodynamic windows--expansion window, compression window and vortex window. The three windows have an aperture of 3 cm and were designed to operate at a cavity pressure of 0.1 atm. While the beam passes through the window, the minimum beam degradation is 1.5 times as large as the diffraction limit of the aperture. The minimum mass flow required for the operation of the window is 0.012 kg/sec·cm^2.

AUTHOR: SUN Zhiwei [1327 4363 0251]
ZHAO Jianrong [6392 1696 2837]

ORG: Both of the Institute of Mechanics, Chinese Academy of Sciences

TITLE: "Influence of Ge-window's Interference Effect on the Stability of CO_2 Laser Output"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 13-16

TEXT OF ENGLISH ABSTRACT: It is believed that the interference effect of the Ge-window is an important factor affecting CO_2 laser output stability. The two parallel surfaces of a Ge-window constitute a Fabry-Parot interferometer, so for an incident laser beam the transmissivity depends sensitively on thickness as a result of interference, and the thickness of the Ge-window varies with laser intensity and ambient temperature. Therefore, it is suggested that this may constitute an important cause of instability of the power output, frequency and transverse mode.

AUTHOR: WANG Yuzhi [3769 3768 5347]
XIE Peiliang [6200 1014 5328]
DONG Jingxing [5516 2529 2502]
FENG Bingfang [7458 3521 5364]

ORG: All of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Experimental Investigation of Electron Temperature in Gas Lasers"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 17-20

TEXT OF ENGLISH ABSTRACT: The average electron temperature has been measured by using a double probe. The influence of the addition of N_2, He, Xe, and that of discharge current, gas pressure on the electron temperature were studied.

AUTHOR: JIN Manwen [6855 2581 2429]

ORG: Beijing Institute of Optical and Electronic Technology

TITLE: "Application of Fabry-Perot Etalon in Dye Lasers"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 21-24

TEXT OF ENGLISH ABSTRACT: According to our experience in solving the problems of adjusting and designing laser monochrometers, this paper presents some points which should be taken into account in applying etalon in the cavity: selection of parameters, some possible phenomena and their solutions. Data and photos used in this paper were obtained in adjusting the model WDJ-1 laser monochrometer.

AUTHOR: ZHANG Shoudu [1728 1343 6757]
ZHANG Shanshan [1728 3790 3790]
ZHOU Liangzhi [0719 5328 2535]

ORG: All of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Influence of Defects in Nd:YAG Crystals on Laser Performances"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 25-28

TEXT OF ENGLISH ABSTRACT: The influence of defects, such as residual stress, facet and scattering particles, in Nd:YAG crystals on the optical properties of crystal and CW laser performances were investigated experimentally.

AUTHOR: LIU Hongju [0491 3163 5282]

ORG: Changchun Institute of Physics, Chinese Academy of Sciences

TITLE: "Coupling of Double-Heterojunction GaAs Laser into Multimode Optical Fibers"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 29-31

TEXT OF ENGLISH ABSTRACT: Some problems on coupling of GaAs heterojunction laser into multimode optical fibers are discussed, and coupling efficiency has been calculated for optical fibers with a microlens.

AUTHOR: HUANG Letian [7806 2867 1131]
WANG Tianji [3769 1131 0644]
LIN Shiying [2651 0099 5391]
ZHANG Shichao [1728 0013 6389]

ORG: All of the Guangzhou Institute of Electronic Technology, Chinese Academy of Sciences

TITLE: "Simple Detection of the Difference between Two Photographs Taken by Satellite ERTS"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 32-34

TEXT OF ENGLISH ABSTRACT: A new method for detection of the difference between two images is presented. In this method, the authors regard a white light speckle patters as a random carrier for optical processing. The experiment demonstrated that it can be used to code information of images in an efficient way, yielding a high degree of redundancy. The results obtained are similar to those by Françon's modulated coherent light speckle patters, but this method is simpler than Françon's.

AUTHOR: CHEN Shouhua [7115 1343 5478]
XU Yuguang [1776 3022 0342]

ORG: Both of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Single-Exposure Holographic Shearing Microinterferometer"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 35-37

TEXT OF ENGLISH ABSTRACT: The interferometer introduced in this paper has such properties as simple optical arrangement for holographic recording, automatic insurance of the optical path quality and reproducibility of recoded wavefronts in different reference backgrounds. It can be applied to interferometry with high temporal and spatial resolution requirements.

AUTHOR: CHEN Yuming [7115 6877]
FENG Daren [7458 1129 0117; deceased]
ZOU Haixing [6760 3189 5281]

ORG: All of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Two-dimensional Lateral Shearing Interferometer"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 38-41

TEXT OF ENGLISH ABSTRACT: A single shearing interferogram is not sufficient to describe a wavefront. Two interferograms sheared in orthogonal directions must be used to reconstruct the wavefront of any arbitrary shape. Two types of two-dimensional lateral shearing interferometers have been studied: orthogonal shearing prism and crossed grating. A method is described that uses data obtained from the interferograms to reconstruct the wavefront. It was used in processing the interferograms obtained in our experiment.

AUTHOR: LI Xishan [2621 6932 0810]
JIANG Anmin [5592 1344 3406]
XIA Qingsheng [1115 7230 3932]

ORG: All of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Holographic Interference Inspection of Striae and Bubbles in Optical Glasses"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 42-45

TEXT OF ENGLISH ABSTRACT: In this paper, holographic interference inspection of striae and bubbles in optical glasses is described. Compared with the conventional methods, this one has the characteristics of higher accuracy and easier automation in inspection.

AUTHOR: ZHANG Xinchang [1728 2450 2490]
SUN Mengjia [1327 1322 0857]

ORG: Both of Shanxi University

TITLE: "Discharge Stability of Gas Laser Tubes Connected in Parallel"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 46-49

TEXT OF ENGLISH ABSTRACT: The conditions for discharge stability in gas laser tubes electrically connected in parallel are discussed, and the coefficient of discharge stability is given. These may provide a theoretical basis for designing power supplies of stable folded gas lasers, as well as a reference in designing power supplies for other discharge tubes electrically connected in parallel.

AUTHOR: GUAN Chongwen [7070 1504 2429]

ORG: Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences

TITLE: "Some Problems of Laser Safety"

SOURCE: Shanghai JI GUANG [LASER JOURNAL] in Chinese No 10, Oct 80 pp 50-52

TEXT OF ENGLISH ABSTRACT: Laser-induced harm on persons in the Shanghai Institute of Optics and Fine Mechanics during more than the past 10 years is reported. Some typical cases are selected and the causes for accidents analyzed. It is pointed out that the reflected light from the laser irradiated spot is a serious hazard to human eyes, and some problems on laser safety are discussed.

9717
CSO: 4009

AUTHOR: None

ORG: Rural Telephone Division, Main Office of Bureau of Telecommunications, Ministry of Post and Telecommunications

TITLE: "Strengthen Rural Telephone Management To Facilitate Rural Communication --National Rural Telephone Work Conference Held in Beijing"

SOURCE: Beijing NONGCUN DIANXIN JISHU [TECHNOLOGY OF RURAL TELECOMMUNICATIONS] in Chinese No 6, 15 Nov 80 pp 1, 4

ABSTRACT: For the purpose of implementing the spirit of the Document No 165 of the State Council (1979) ordering a strengthened management of rural telephone system, the Ministry of Post and Telecommunications called the conference. It was held in Sep and attended by 79 delegates representing the leaders, the management staff, etc. of rural telephone bureaus all over the country. The delegates discussed 5 related documents and proposed revisions to them. Experiences regarding perfecting the management structure, practicing independent accounting, strengthening business management and equipment maintenance, improving the quality of communication and personnel training, etc. were exchanged. Since the establishment of the nation, a rural telephone system has been developed out of nothing. While affirming the accomplishments, outstanding problems were seriously debated and many valuable opinions and proposals offered. These are summarized.

AUTHOR: YAN Jinde [0917 2516 1795]

ORG: None

TITLE: "Effect of AC Electrified Railroad on the Rural Communication Line and Preventive Measures"

SOURCE: Beijing NONGCUN DIANXIN JISHU [TECHNOLOGY OF RURAL TELECOMMUNICATIONS] in Chinese No 6, 15 Nov 80 pp 22-25

ABSTRACT: On an AC electrified railroad, the drawing capacity of the locomotive is very great to enable the train to run up mountain slopes in full power. It is, therefore, being extensively developed here and abroad. In order to protect the road maintenance workers and the wood-poled rural communication lines, the current on the rail must not exceed 60 v; 36 v if the rural telephone poles are made of concrete. These are other standards to prevent the adverse effects of electrified railroad and to insure the safety of rural communication lines are discussed.

AUTHOR: None

ORG: Hebei Provincial Post and Telecommunications Management Bureau

TITLE: "Shop Arrangement of a Rural Post and Telecommunications Branch Office"

SOURCE: Beijing NONGCUN DIANXIN JISHU [TECHNOLOGY OF RURAL TELECOMMUNICATIONS] in Chinese No 6, 15 Nov 80 pp 40-41

ABSTRACT: With respect to the construction of the branch station, the paper reports that a room on the north side of the building with a southern exposure is necessary to provide plenty of light and to prevent dampness; a brick and wood structure with a concrete fllor for the magnetic telephone instrument, and the ceiling should not be less than 2.5 m from the floor; the battery should be placed in an adjacent room to shorten the required length of the cable as well as to prevent the acid vapor from infiltrating the equipment (if the battery is in the same room.) The equipment should be suitably arranged in the room which should be large enough for orderly maintenance and small enough to save cable and construction area. There should not be unnecessary pictures, slogans, diagrams, etc. on the wall. It is best to place the magnetic switchboard on the north side to face the south. The distance between the switchboard, the cable rack, the income cable shelf, the carrier wave machine, the conference telephone equipment, and the electrical power equipment should be 0.8-1.0 m. In a manual switchboard shop, there should not be a stove-type heater, which may be placed in an adjacent room to provide warmth through a duct but a fire-wall is necessary to separate the furnace room from the equipment shop. This paper is excerpted from a maintenance manual.

AUTHOR: LI Zhenqiu [2621 2182 3808]

ORG: Telephone Office, Sixth Division, Xiang Mei [Hunan Coal Company ?]

TITLE: "A Minor Improvement in the Calling Signal of the General Telephone Machine"

SOURCE: Beijing NONGCUN DIANXIN JISHU [TECHNOLOGY OF RURAL TELECOMMUNICATIONS] in Chinese No 6, 15 Nov 80 p 41

ABSTRACT: The signal light of the branch switchboards in the office where the author works had a milky white cover. When the sunlight shines in sideways, it was difficult for the operator to be aware of it when the light went on. For awhile an alarm was added to alert the operator who had to begin to look for the customer's line after he heard the alarm. His work efficiency was not improved. The author and colleagues replaced the milky white cover of all the signal lights with a red cover. Now the operator knows instantly when and where the call comes from.

6168
CSO: 4009

AUTHOR: None

ORG: Institute of Ship Engineering, Hudong Shipyard

TITLE: "The 7500-ton Passenger-cargo Vessel

SOURCE: Shanghai CHUANBO GONGCHENG [SHIP ENGINEERING] in Chinese No 6, 80 pp 1-6, 23

ABSTRACT: Since the 7500-ton class passenger-cargo vessel, Changzheng, was completed by Shanghai Hudong Shipyard in 1970, 8 more sister vessels have been launched there with 3 more under construction. They now sail regularly between Shanghai and one of the following cities of Dalian, Qingdao, and Wenzhou, as well as between Dalian and Yantai. This is a class of primarily passenger vessels, with an additional capacity of 2000 tons of miscellaneous cargo. Designed to navigate in and out of China's coastal harbors of all sizes, they may also sail up the Yangzi if necessary. In linear design, Linblad, A.F 's model ship experimental data were used as reference, with some changes to enlarge the area of the deck and to reduce splashing. When the major engine has a rating of 2 x 4500 hp, the speed is 18.1 knots. Their continuous navigation capacity is 3500 nautical miles, with an additional fuel supply of 9 days for loading and unloading. The freshwater supply is calculated at 60 kg/person/day. The engine and other equipment are described.

AUTHOR: CAI Tiankai [5591 3944 0418]
CAO Guantong [2580 7070 2717]
XU Tongquan [6079 4827 6898]

ORG: None

TITLE: "Design and Development of the River Waterjet Sidewall ACV [Air Cushion Vessel]"

SOURCE: Shanghai CHUANBO GONGCHENG [SHIP ENGINEERING] in Chinese No 6, 80 pp 7-14

ABSTRACT: In cooperation with Shanghai Institute of Shipping Sciences and Anhui Provincial Bureau of Transportation, the Chaohu Shipyard, in the process of studying and constructing air cusion vessels for inland navigation, carried out some investigations concerning the use of sidewall ACV in shallow inland channels and problems of improving the economic efficiency, simplifying the power equipment, and the feasibility of using glass fiber reinforced plastic to make the body. In 1975, a 5-ton waterjet sidewall ACV experimental prototype was completed to form the basis for future design and development of such passenger vessels. Some beneficial experience has thus been gained. The major parameters of the vessl, the structure of the body, the propeller mechanism, and the power equipment are described.

AUTHOR: SHI Mingchuan [2457 6800 1557]

ORG: None

TITLE: "MnNb Steel--A Sea Water Corrosion Resistant Steel"

SOURCE: Shanghai CHUANBO GONGCHENG [SHIP ENGINEERING] in Chinese No 6, 80 p62

ABSTRACT: On the line between Shantou Harbor and Nanao Island, the passenger-cargo vessel, Shanao No 1 navigates regularly back and forth. It is just an ordinary passenger-cargo ship, but its body is made of the sea water corrosion resistant manganese-niobium steel. It was launched in 1971 and has been in use ever since. To date, not a single steel plate of the ship had to be replaced due to rust. The MnNb steel material was made by Tangshan Steel and Iron Mill and rolled and processed by Jinan Steel Plant. Originally, the deck had 4 skylights to ventilate the cabins below but leakage of sea water was a regular problem. In 1977, SM41B steel plates made in Japan were used to weld and close these openings. These have now obviously been rusted through, while the deck surrounding these remains perfect. This paper reports the findings of the vessel's once-a-year scheduled maintenance last Aug. When the old paint was scraped off for repainting, the body of the vessel was found to be as smooth as black marble. MnNb steel is now being used in China to make pipelines for gas and oil transport, mining equipment and vehicles, and dreges.

6248
CSO: 4009

AUTHOR: SONG Shunhua [1345 7311 5478]

ORG: None

TITLE: "1 MHz Remote Control Video Telephone Equipment and Its Application"

SOURCE: Shanghai DIANXIN KUAIBAO [TELECOMMUNICATIONS INFORMATION] in Chinese No 11, Nov 80 pp 34-39

ABSTRACT: A 1 MHz remote control video telephone system has been successfully made by the First Research Institute of the Ministry of Telecommunications and is actually in operation. This paper introduces the major properties of its terminal instrument, its design considerations, and its application. In the future, more papers will be published in this journal to introduce the switching and the municipal cable transmission equipment in this remote control video telephone system. A photo is attached to depict the various components of the video telephone system.

6248
CSO: 4009 END

END OF
FICHE
DATE FILMED

24 March 1981